Immigrants, Productivity, and Labor Markets

Giovanni Peri

Although news reports often make international migration sound like a succession of unprecedented crises, immigration from lower-income to higher-income countries has actually been a steady force operating at a roughly constant rate during the last 50 years. There have certainly been year-to-year fluctuations and the combination of sending and receiving countries has changed somewhat over time, but a sustained and common trend is clear over the long run.

Figure 1 shows the evolution of foreign-born individuals as share of the total population in the main receiving rich countries. The United States is represented by the solid line. Europe (as summarized by 13 countries that were members of the European Union before the 2004 expansion, plus Switzerland and Norway) is shown by the dashed line. The combination of Canada and Australia is shown by the dotted line. The three country groups show a similar growth of foreign-born as share of the population: that is, an increase by 8–9 percentage points of the population over the period from 1960 to 2015, or about 0.2 percent per year.

Of course, the timing of the increase in immigration isn't identical, and year-to-year fluctuations are omitted from the graph, which connects census-year points. But as a whole, Europe experienced acceleration in the growth of the foreign-born population share since 1990 with the opening of Eastern Europe and larger migrations from North Africa. Individual European countries had a variety of immigration experiences, and Table 1 provides some of the most recent figures. Some countries, such as Austria, Luxembourg, Switzerland, Sweden, and Ireland, reached

■ *Giovanni Peri is Professor of Economics, University of California-Davis, Davis, California. His email address is gperi@ucdavis.edu.*

Figure 1
Foreign-Born as Share of the Population
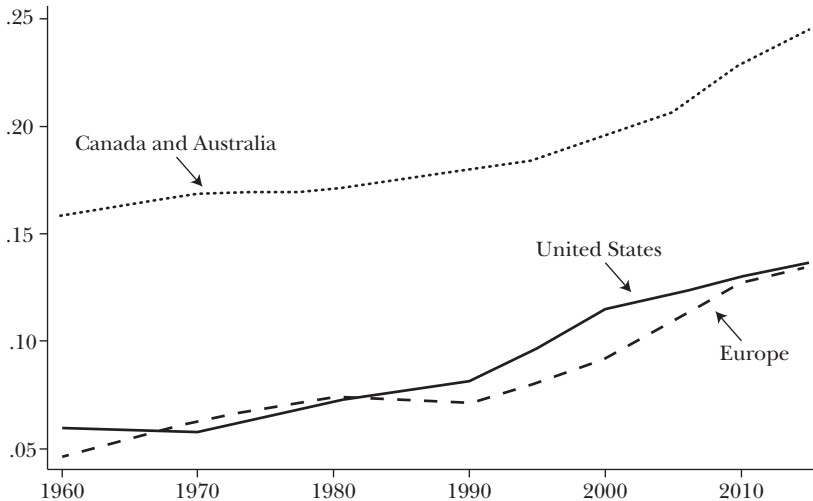
Sources: Original data sources are the National Censuses and other National Population surveys. For the period 1960–1980, we use the aggregation of immigrants reported in World Bank (2012), while for the period 1990–2015, we used United Nations (2015). Total Population data are from the World Bank.
Notes: The figure shows total foreign-born as share of the total population in the United States, Europe, and Canada-Australia. The countries included in what we call Europe are 13 countries of Western Europe that first joined the European Union before 2004 (Austria, Denmark, Finland, France, Germany, Greece, Ireland, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom—excluding Belgium and Italy for which data are not available) plus Switzerland and Norway.

shares of immigrants above 15 percent in 2015, with fast growth during the previous two decades. In some cases, such as Spain and Ireland, the last 20 years marked the only period of significant immigration, beginning with a very small foreign-born population in 1995. For other countries, such as Finland and Portugal, immigrants as percentage of population are still in the single digit. Looking again at Figure 1, we see that, relative to Europe, the United States has been on a roughly steady immigration trajectory since 1970, with a faster rate in the 1990s (a period of large immigration from Mexico). Canada–Australia experienced an acceleration during the ten years since 2005. In 2015, about 13 percent of the population in the United States and Europe and about 25 percent of the population in Canada and Australia was foreign-born.

The presence of foreign-born in Europe, the United States, Canada, and Australia increased significantly over the last four decades, despite the fact that immigration policy did not become significantly more open in these countries over the same period. For example, in the United States, the Immigration and Natural-ization Act of 1965 established the prevailing principles and rules that still govern immigration policies. Although all of these nations have seen some changes to

Table 1
Immigration in European Countries

Country in Europe	Share of immigrants in population 2015	Change in immigrant share 1995–2015	Country of origin of the largest groups of immigrants		
			Largest	*2nd largest*	*3rd largest*
Austria	0.17	0.06	Germany	Serbia	Turkey
Denmark	0.10	0.04	Germany	Turkey	Poland
Finland	0.06	0.04	Estonia	Sweden	Russian Federation
France	0.12	0.02	Algeria	Morocco	Portugal
Germany	0.15	0.06	Poland	Turkey	Russian Federation
Greece	0.11	0.03	Albania	Germany	Georgia
Ireland	0.16	0.10	United Kingdom	Poland	Lithuania
Luxembourg	0.45	0.14	Portugal	France	Italy
Netherlands	0.12	0.03	Turkey	Suriname	Morocco
Norway	0.14	0.09	Poland	Sweden	Lithuania
Portugal	0.08	0.03	Angola	Brazil	France
Spain	0.13	0.10	Morocco	Romania	Ecuador
Sweden	0.17	0.06	Finland	Iraq	Poland
Switzerland	0.29	0.09	Germany	Italy	Portugal
United Kingdom	0.13	0.06	India	Poland	Pakistan

Sources: The original data sources are from National Censuses and other National Population surveys. We include the 15 countries of Western Europe for which United Nations (2015) reports data on foreign-born population by country of origin consistently for the last two decades. Data on total population are from the World Bank.

immigration policies over time, those changes have not consistently reduced the entry barriers to immigrants (Ortega and Peri 2013).[1] Thus, the continuing growth in the share of foreign-born residents in these countries has been primarily driven by persistent economic and demographic forces, rather than by a policy shift aimed at opening the borders.

In this essay, I will describe the key facts about immigration to high-income countries. I will also discuss the evolution of the framework that economists use in

---

[1] The United States has seen two important changes in the last half-century that, although they did not alter immigration policy in a fundamental way, are worth mentioning. First, the Immigration Reform and Control Act of 1986 regularized the status of a large number of undocumented immigrants. It was followed by a high level of tolerance for the inflow and the employment of low-skilled undocumented workers during the 1990s. Second, the H-1B temporary visa program established in 1990 has subsequently become the main channel of entry for work-related high-skilled immigrants, many of whom have eventually become US residents.

thinking about its economic effects. Twenty years ago, economists typically framed their analysis of immigration as an increase in the supply of labor within a model of homogeneous workers and a downward-sloping labor demand, which was determined by the complementarity between labor and physical capital.[2] This approach tended to focus the attention of the researcher on how immigrants competed with other homogeneous workers in the labor force while keeping everything else fixed, in a "partial" view of the labor market. More recent analyses offer greater flexibility. Researchers now distinguish different types of workers by their education and other important skill dimensions (such as ability in performing manual or analytical tasks). Moreover, immigration is now analyzed in a framework that looks at its total effects and accounts for many responses to immigrants: from native workers, in terms of possible complementarities and degrees of specialization; from firms, in terms of choices about capital and technology; and even from consumers, in terms of the mix of goods and services they choose to purchase. Unsurprisingly, this framework has produced a richer set of possible effects of immigrants on wages and employment of natives. Indeed, not only economists studying labor markets but economists studying regions, firms, trade, and investments have begun analyzing the multifaceted impact of immigration.

Trends in Origins and Skill Levels of Immigrants

Up until about 1990, immigrants from other high-income countries represented a significant share of total immigrants, especially in inter-European migration and in Canada and Australia (which received a large share of migrants from Europe). However, the growth of the foreign-born population during the last 25 years has been mostly fueled by the growth in immigrants from nonrich countries. In the United States, immigrants from nonrich countries, especially from Asia and Latin America, were the largest part of the foreign-born population already in the 1970s, and the whole increase since 1990s has been due to their growth. In Europe, however, immigration from Asia, Africa, and Latin America was much less prevalent before 1990. Figure 2 shows for the United States (solid line), Europe (dashed line), and Canada–Australia (dotted line), the immigrants from nonrich countries (that is, originating outside of this group itself) as share of the population since 1990. The growth of that group accounts for the whole growth of foreign-born, expressed in terms of population share, experienced in those country groups during the period considered (compare with Figure 1).

Two qualifications of this phenomenon are important. First, the "nonrich" countries with largest emigration rates to high-income countries are those at intermediate levels of economic development, like countries in Latin America (for

---

[2] As an example of discussions based on this approach, this journal published a three-paper "Symposium on Immigration" in the Spring 1995 issue, assessing the labor market impact of immigrants in 1995. Borjas (1995) and Friedberg and Hunt (1995) are two very highly cited essays from that issue.

Figure 2
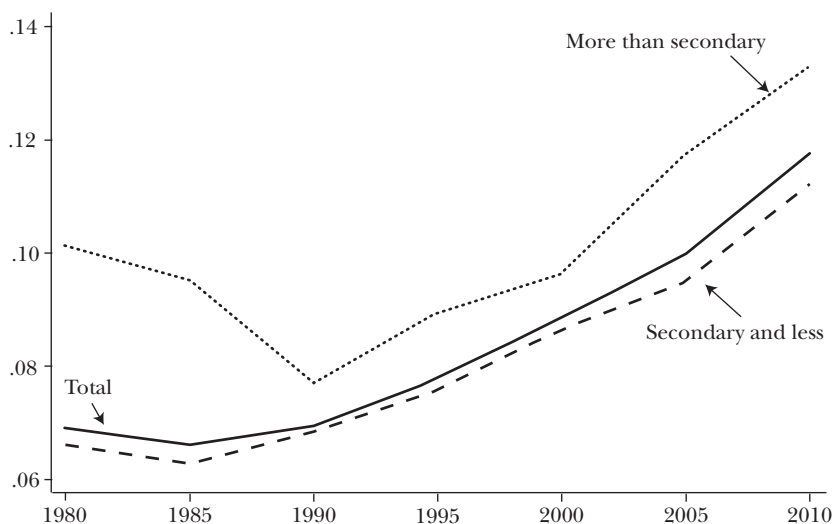**Foreign-Born from Nonrich Countries as Share of the Population**
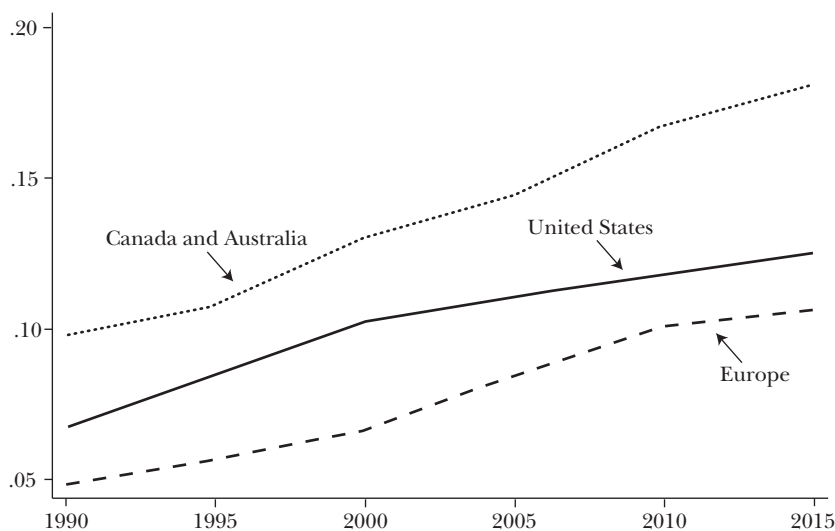
Notes: The figure shows foreign-born from outside of Europe, the United States, Canada, and Australia as percentage of the population. The solid line represents the figures for the United States, the dashed line for Europe (as defined in Figure 1), and the dotted line is the aggregation of Canada and Australia. The period covered is 1990–2015.

example, Mexico), East Asia (for example, the Philippines), or North Africa–Middle East (for example, Algeria or Morocco), but not the poorest part of the world like the countries of sub-Saharan Africa. Since 1990, about 50 percent of immigrants to the United States, Europe, Canada, and Australia were from Asia, 30 percent from Latin America, and only 20 percent from Africa. Emigration is generally low from very poor countries; indeed, growth in income and education in very poor countries is frequently associated with increased emigration rates because migration becomes more affordable and economic returns to emigration grow. Emigration to high-income countries is better described (as in Clemens 2014) as a phase in the economic development of a country rather than an escape valve for countries most deeply mired in poverty.

A second important qualification is that, while immigration from nonrich countries often conjures images of large masses of unskilled laborers, in reality it has been quite skill-intensive. The composition of immigrants into high-income countries, even if they originate from countries with lower income per person, tends to be more concentrated among highly educated than among less educated, relative to the population of the country of destination. Grogger and Hanson (2011) show that highly educated people are much more likely to migrate and obtain the largest economic gains from migration. Figure 3 shows the trends over time for

Figure 3
**Foreign-Born Share in Europe, by Schooling Group**

Notes: The figure aggregates the 15 countries included in our definition of Europe. It shows the foreign-born share of the population (thick bold line), the foreign-born share for the population with a secondary education or less (dashed line), and the foreign-born share for the population with more than secondary education (dotted line). The period covered is 1980–2010.

migrants to Europe: the thick line shows the foreign-born share of the population; the dashed line shows the foreign-born share for the population with secondary education or less; and the dotted line shows the foreign-born share for the population with more than secondary education. A qualitatively similar pattern appears in the data for Canada and Australia (not shown): that is, the foreign-born were overrepresented in the higher education group vis-à-vis natives. If we consider that natives in the receiving countries increased significantly their level of schooling during the considered period, and also that the average schooling in countries of origin of immigrants was usually lower than in the receiving countries, we realize that immigrants were very positively and increasingly selected along the education dimension. Thus, migrants from nonrich countries were highly educated not just relative to other people in their countries of origin (Docquier and Marfouk 2004; Docquier, Lohest, and Marfouk 2005; among others) but, usually, also relative to the country of destination (Docquier, Ozden, and Peri 2014). This strong selection can be rationalized by the fact that highly educated individuals are those for which absolute returns to migration are largest, because rich–poor country wage differentials between skilled workers are larger than the differentials between low-skilled workers.

Figure 4
Foreign-Born Share in the United States by Schooling Group
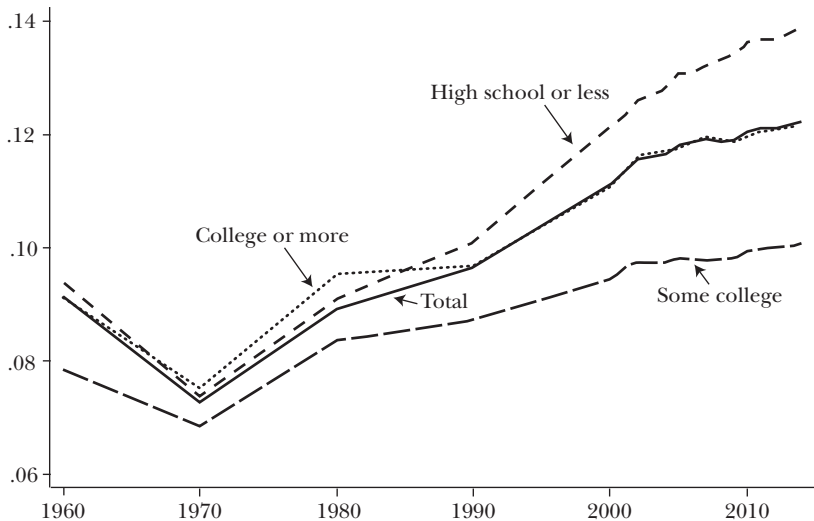
Notes: The figure is relative to the United States. The solid line represents foreign-born as share of the resident population, 18 years and older. The short-dashed line represents foreign-born with high school degree or less as share of residents with high school degree or less. The long dashed line represents immigrants with some college education but no degree as share of the residents with some college but no degree. The dotted line represents the college-educated foreign-born as share of college-educated residents. The source of data is the US Census 1960, 1970, 1980, 1990, 2000, and, yearly, American Community Survey, 2000–2014.

Figure 4 shows these patterns for the United States since 1960. The solid line shows the foreign-born share of the US population, and then the US population (older than 18) is divided into three groups: those with high school diploma or less, those with some college education, and those with a college degree or more. US immigrants were underrepresented at intermediate levels of "some college" education, shown by the long-dashed line. However, they were overrepresented both among less-educated (short-dashed line) and among college-educated-or-more, shown by the dotted line. Figure 5 illustrates this point more vividly. It presents the share of foreign-born as of 2014 divided into eight education groups, showing that US immigrants are overrepresented at the two extremes of this skill distribution. One-third of US workers with a PhD and a job in a STEM (science, technology, engineering, and mathematics) field were foreign-born in 2014, as well as 40 percent of workers with no high school diploma. We will discuss the implications of this distribution in the next section.

An additional fact about the distribution of foreign-born in the United States is that the immigrant population tends to be much more spatially concentrated than the native population (as discussed in Lewis and Peri 2015). Only

Figure 5
Foreign-Born Share of Employment by Schooling Group, United States, 2014
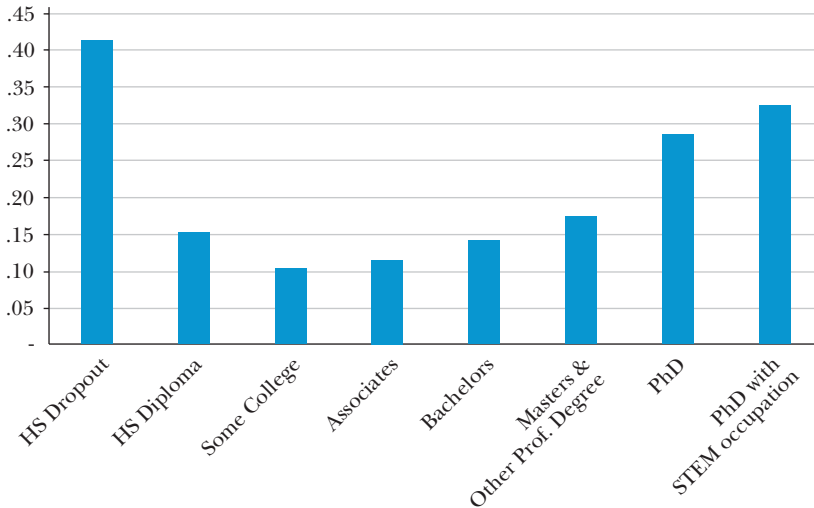
Source: The data include US residents 18 years and older from the ACS 2014.
Notes: The groups are defined as follows: "HS Dropout" is the group with no high school diploma. "HS Diploma" is the group that has a high school diploma as highest degree and no further education. "Some College" is the group with a diploma and some college attendance but no degree. "Associates" is the group with an associate degree. Bachelors" is the group with a Bachelor degree. "Master and Other Professional Degree" is the group with a Master degree or a professional (law, medical) degree. "PhD" is the group of people with a PhD. "PhD with STEM occupation" is the group with PHD employed in STEM occupations as defined in Peri, Shih, and Sparber (2015).

5 percent of the US rural population is foreign-born. However, that share grows to 8 percent in urban areas that are not in the top 100 in terms of population, to 12 percent among the top 100 metro areas by population, to 30 percent in the top ten metro areas by population, and 39 percent in the top two metropolitan areas of New York and Los Angeles. This tendency to agglomerate in large urban areas as well as the large college share of immigrants (and even more, the large share of immigrants among those with science, technology, engineering, and mathematics degrees) implies that immigrants could be contributing to human capital agglomeration and density externalities. Faster learning, better employer-employee matches, lower transportation costs, cross-fertilization of ideas, and similar productivity-enhancing externalities—of the type identified in Ciccone and Hall 1996; Moretti 2004a and b; Greenstone, Hornbeck, and Moretti 2010; and Iranzo and Peri 2009—could be strengthened by the described features of US immigrants. The next section explores economic frameworks that lay out the channels for these effects and, in general, for the effects of immigrants on labor productivity and wages.

Canonical and More Recent Economic Frameworks

When analyzing the labor market impact of immigrants on wages during the 1980s and 1990s, economists usually started within a basic framework sometimes called the "canonical" model. This approach considers immigration as a change in supply of homogeneous aggregate labor. It assumes that the most relevant factor determining labor demand (that is, marginal productivity of labor) is the amount of physical capital, which is considered fixed in the short run and adjustable in the long run. Hence the only predicted effect of increased immigration in this model is an increase of labor supply along a downward-sloping demand curve in the short run and then a movement along a horizontal demand curve in the long run, when capital adjusts (as long as we assume constant returns to scale to capital and labor). When using this model, economists asked: "What is the elasticity of labor demand in the short run?" The answer would determine the extent of the negative effect of immigration on native wages in the short run.

The last 20 years of research have shown that this canonical model excessively constrains our understanding of the effects of immigration. More recent frameworks have offered several variations and typically have incorporated four features that are absent or undeveloped in the canonical model: 1) immigrants are analyzed as a change in the supply of heterogeneous workers[3] in a general equilibrium context; 2) there is significant variety and differentiation between the kinds of tasks that immigrants and natives are more likely to perform; 3) native workers and firms can shift their choices in response to immigration; and 4) immigrants may affect the total factor productivity at the local (city, region) level.

Skills of Immigrants and Skills of Natives

A first aspect of the new framework is that it moves away from analyzing immigration as a partial equilibrium change in the quantity of homogeneous labor supply. Instead it considers immigration within the framework of general equilibrium changes of heterogeneous labor supply. Specifically, it views immigrant workers, as providing differentiated inputs in production, where a key aspect differentiating the inputs of workers is their level of education. Moreover, as the inflow of immigrants has been a continuous phenomenon, protracted across the decades (albeit with yearly fluctuations), this framework recognizes that physical capital has adjusted at comparable speed requiring a general equilibrium approach.

---

[3] As many readers will recognize, other fields of economics have evolved along roughly similar lines. For example, international trade economists have learned the advantages of analyzing trade between heterogeneous firms with different productivity (Melitz 2003) while allowing for the possibility of trading and offshoring productive tasks (Grossman and Rossi-Hansberg 2008). Labor economists have learned the importance of thinking within a framework where heterogeneous workers and machines perform productive tasks with different degrees of complementarity and substitutability (see the excellent review in this journal by Autor 2015). The framework here achieves similar progress in thinking of the effects of immigrants on labor market outcomes and productivity of natives.

The choice of how to partition workers of different education levels into different and complementary (rather than easily substitutable) production skills has been a debated topic. It is an important choice because the partition of skill groups and their degree of complementarity has implications for how changes in relative demand and relative supply translate into wage changes. A group of studies (such as the seminal paper by Card and Lemieux 2001, and then Card 2009; Goldin and Katz 2008; and Ottaviano and Peri 2012) has argued that the most relevant partition across workers by education groups is between people with at least some college education and people with a high school degree or less. We will call these two groups "college-educated" and "non-college-educated." These two groups of workers tend to be employed in different occupations. They use different technologies and are characterized by different productive abilities. More importantly, the relative wage of college-educated has grown relative to non-college-educated during the last 40 years, driven by technological and structural change, and it has also been negatively affected by their relative supply, revealing a significant degree of complementarity between these two groups (Autor, Katz, and Kearny 2008).

Another line of research, however, emphasizes that further partitioning along the schooling dimension is needed to understand the impact of immigrants (for example, Borjas, Grogger, and Hanson 2012). In particular, workers with no high school degree and workers with just a high school degree should be considered as differentiated and complementary rather than as substitutes. This choice would imply a more concentrated competition effect of immigrants among workers with no degree (where supply of immigrants is larger) and positive complementary effect on workers with just a high school degree. We do not think that the balance of empirical evidence supports this assumption, as relative wages of high school dropouts and graduates do not seem to respond to changes in their relative supply, either at the national (Ottaviano and Peri 2012) or the local level (Card 2009).

We recognize, however, that the estimate of elasticity of substitution across education groups is sensitive to the empirical specification and to the identification assumptions (a point made in Borjas, Grogger, and Hanson 2012), and hence there is room for disagreement on this issue. Other subpartitions of immigrant skill levels according to experience or age have been used, but workers' productive skills seem significantly more interchangeable (substitutable) across ages, and we will not focus on this dimension here.[4]

Considering "college-educated" and "non-college-educated" as the two relevant labor inputs has two consequences. First, the inflow of immigrants to the United States was quite balanced, nationally, between these two education groups: In 2014, the percentage of foreign-born among US workers with less than a college degree

---

[4] The age structure of immigrants could be relevant in affecting relative wages of young and old workers, but the literature has not focused much on this issue. Potentially more relevant is the fact that, as immigrants are younger than natives, they can reduce the dependency ratio and help fund social security in rich countries. This point has been made in several policy reports and anecdotally, but we do not know of academic papers that analyze this effect in detail.

was 16.9 percent, and among those with college or more it was 16.1 percent. Thus, the effect of immigration on the relative supply of these two types of labor was limited. Hence, purely through forces of substitution or complementarity, US immigration would not have much effect on relative wages of college and non-college workers at the national level. Second, as US immigration was a continued and fairly steady phenomenon during the last 40 years, capital could adjust (as argued in Ottaviano and Peri 2012), so also the absolute wage of each group should have remained rather stable in response to immigration. These considerations suggest that if we limit the focus to relative skill supply and physical capital adjustment, and if we emphasize the college/non-college division as the most relevant skill partition, the general equilibrium effects of immigration on wages of natives during the last decades should have been quite small.

Differentiation among Productive Tasks

The second aspect of the new framework is that within the group of college- and non-college-educated, it can be useful to consider workers as differentiated in their supply of productive "tasks." For the group of non-college-educated, it makes sense to separate the supply of manual tasks, which are more commonly performed by immigrants, and nonmanual tasks—mainly communication-interaction tasks— more commonly performed by natives. For example, if we rank occupations by their manual content (defined as intensity of use of eye-hand-foot coordination measured by the Dictionary of Occupational Titles produced by the US Department of Labor), we find that in 2014 the foreign-born made up about 18 percent of noncollege workers doing jobs with little manual content, but about 32 percent of the jobs with the highest level of manual content (based on our own calculations using US Department of Labor information on occupation skill content and American Community survey data). For the group of college-educated, on the other hand, it makes sense to separate what are often called the math-analytical tasks from the rest, which can be broadly classified as managerial-communication tasks. Immigrants with college education are more likely to have jobs that focus on tasks in the math-analytical category. With immigrants changing the relative supply of manual and math-analytical abilities within the two education groups, this could generate depressing effects on wages in manual tasks (within non-college-educated) and in math-analytical tasks (within college-educated). Through complementarity, it would also generate an increase in the wage of nonmanual and nonmath-analytical occupations, which would disproportionately benefit native workers.[5]

---

[5] If one is not interested in analyzing the mechanism at work with regard to the tasks and occupational specialization of immigrants and natives, but only the wage effects of immigration on natives of different education levels, then one can simply consider the college- and non-college-educated to be imperfectly substitutable inputs, and immigrants and natives to be imperfectly substitutable subgroups within each of those. Because of specific skills, abilities, and preferences, these two groups are imperfect substitutes, and one can estimate the degree of complementarity with natives and the implied relative wage effects from an inflow of immigrants with given skill distribution. This has typically been done in a nested constant elasticity of substitution production function framework (Ottaviano and Peri 2012; Manacorda,

The principle of comparative advantage can help explain why US migrants are especially prevalent in physical-manual and math-analytical types of tasks. Manual abilities are transferrable across countries but communication abilities (especially if native languages are different) are much harder to transfer. Hence, non-college-educated immigrants working in the US have comparative advantages in manual tasks. For college-educated immigrants, math-analytical skills are more easily transferred across countries than managerial and communication skills, which are more culture and country specific. Moreover, college-educated immigrants are a selected group with high ability levels.

Margins of Adjustment

A third important aspect of the new and more general framework is that it considers workers' and firms' responses to the changes in relative supply of productive skills brought by immigrants. In general, native workers will tend to move away from task/skills supplied by immigrants and towards tasks/skills complemented by them.

Task and skill supply will respond, slowly, to relative wages. This adjustment may occur, in part, through changes in the educational choice of natives (within college or noncollege groups) by adding a few years of schooling; for example, Hunt (2012) finds that in areas with a large inflow of noncollege immigrants, natives tend to complete high school at higher rates. The shift can also take place by choosing different areas of study. However, it mostly takes place as native workers move towards occupations that specialize in abilities complementary to those of immigrants. Hence, as immigrants are absorbed in manual jobs (such as construction workers, food industry workers, housekeepers, cleaning crews, and waiters), less-educated natives move to more communication-intensive jobs (construction site supervisors, restaurant managers, farm managers, sale representatives, and similar occupations), whose relative demand increases. This response, together with the change in relative wages, will enhance the complementarity and reduce competition between immigrants and natives of similar educational levels (Peri and Sparber 2009). As for the college-educated group, while foreign scientists and engineers are hired in US companies, native highly-skilled workers pursue more managerial-organizational careers attracted by the premium paid by those jobs, again spurred by complementarity and limited competition with the math-analytical immigrant workers (Peri and Sparber 2011). The idea of individuals adjusting their occupational choice in response to relative compensation is at the base of the Roy (1951) model. The current framework considers it as a task-intensity choice.

Native workers might respond with geographic mobility, too: for instance, native workers can move out of a local economy, like a city or region, if their skills

Manning, and Wadsworth 2012). The results for the US economy as an aggregate imply zero to small positive wage effects of immigrants on natives, which arise as a direct consequence of the balanced college–non-college distribution of immigrants and their small degree of imperfect substitutability with natives. The task framework, however, allows us to "open the box" and study in greater detail one important mechanism through which immigrants and native are different, and it introduces further testable predictions of the impact of immigrants on natives.

are substitutes (or move in if their skills are complements) with those of immigrants. While there is some debate on the geographical mobility of natives in response to immigrants, most studies do not seem to find a very significant role for it (for example, Peri 2012; Peri and Sparber 2009), potentially because other mechanisms already reduce wage impacts and because of moving costs.

A different type of adjustment may also occur at the firm level. Firms choose technology, often associated with a specific type of capital equipment, also responding to the skill supply in the labor force (as illustrated in Acemoglu 2002). For instance, facing a larger supply of manual skills, firms will choose more manual-intensive techniques (possibly reducing mechanization of some processes, as shown in Lewis 2011), or in some locations in which immigration is non-college-intensive, firms can use technology that makes more intensive use of such workers (as shown in Peri 2012). Both adjustments will attenuate any downward effect of skill supply on wages by increasing the productivity of the abundant factor. Moreover, such adjustments may come with efficiency gains and thus some overall boost in average wages of both native and immigrant workers.

Externalities of Immigration

The fourth important aspect of the new framework is that immigrants may generate productive externalities. Several mechanisms are potentially important here.

First, because of the overrepresentation of immigrants among college-educated and science and engineering jobs, immigrants may improve learning and promote innovation at the local level (as illustrated by Kerr and Lincoln 2010; Hunt and Gauthier-Loiselle 2010). A series of papers has argued for positive productivity effects of college-educated in US cities (Moretti 2004a, b; Iranzo and Peri 2009). More recently, local productive externalities of scientists and engineers have been specifically measured (Peri, Shih, and Sparber 2015), and the local multiplier effects of high human capital jobs have been found (Moretti and Thulin 2013).

Second, given the tendency of immigrants to concentrate in urban and particularly in higher-population areas, immigrants may enhance agglomeration externalities by increasing the density of economic activity (as in Ciccone and Hall 1996) based on co-location, reduction of transport costs, increases in local learning, and thicker and more efficient labor markets (Ellison, Glaeser, and Kerr 2010; Greenstone, Hornbeck, and Moretti 2010; Chassamboulli and Palivos 2014).

Yet another channel of positive local productivity effects, potentially important but harder to measure, is that productive benefits may arise from "place of birth" variety in workers, which in turn may generate a greater variety of ideas and increase the variety of goods and services supplied locally (as in di Giovanni, Levchenko, and Ortega 2015) or enhance productivity (Ottaviano and Peri 2006; Ortega and Peri 2014; Trax, Brunow, and Suedekum 2012). In some local services like restaurants and entertainment, the variety brought by foreign-born workers may enhance the amenity value of a location, and make it more attractive to (some) natives. Similarly immigrants may increase the supply and lower the price of some local nontradable services, such

as housekeeping, gardening, and child care (Cortés 2008; Cortés and Tessada 2011). This may increase the real income of native residents who consume those services at lower cost and, at the local level it may act as a positive productivity boost.

Finally, if immigrants increase the price of fixed local factors such as land, they may have a negative externality effect on real wages. Land is not a very relevant factor in production in the US economy, but its value can be an important component of housing prices and rental services. Hence, economists have analyzed how immigrants impact the price of housing across US metropolitan areas. Saiz (2007) finds a significant positive effect of immigration on housing costs, which can be due to a constrained supply of housing and represents a crowding externality. However, if accompanied by growth in wages and employment (as in Ottaviano and Peri 2006), it may also in part reflect the higher willingness-to-pay of individuals due to the amenity value of local goods and service variety brought by immigrants, especially by the highly skilled among them.[6]

Overall, this broader framework for assessing the effects of immigration has important implications. It brings to center stage the analysis of general equilibrium effects of immigration, rather than focusing on partial effects only. Combining the college/non-college framework, physical capital adjustment, and the skill-supply and technology response to the manual and math-analytical changes in skills brought by immigrants, it implies that immigration may not have a strong impact on native relative or absolute wages. Several margins of adjustment will work to reduce the impact of immigrants. The framework also predicts a change in specialization of natives in response to immigration, and it opens the possibility for a positive long-run effect on productivity through local externalities and local price and variety effects. Within this rich set of possibilities, we now turn to the empirical analysis.

Empirical Evidence

The recent empirical literature has made progress in estimating some important parameters that determine the intensity of relative wage effects across skills, as well as parameters that capture the margin of response of native specialization and productivity.

We begin here with the so-called "national approach," which focuses on immigration changing the relative skill supply in labor markets, largely leaving aside other considerations. Those studies consider different skill groups within the whole US as separate labor markets whose demand are connected by their relative substitutability or complementarity in production (such as Borjas 2003; Ottaviano and Peri 2012). This approach focuses on the analysis of complementarity across skills, but it ignores the margins of change in native supply/specialization and the

---

[6]Diamond (2016) finds that the share of college-educated in a metropolitan area represents a very important amenity and that people, especially the highly educated, are willing to pay for it in the form of higher house price and rents.

technological adjustment, discussed above. We then turn to the studies focused on the margins of adjustment of native labor supply, and on technology adoption and on externality effects of immigrants. Because these effects are more likely to be localized, researchers have mainly used area-level data, especially analyzing metropolitan areas or states. Finally, we turn to quasi-experiments, which study the effects of an exogenous and sudden shift that affects immigration.

All of these approaches are useful and informative. We will discuss what we can learn from each, as well as potential limitations and how economists have improved identification strategies and their understanding of the general equilibrium effects of immigrants using each approach.

National Approach: Focus on Skill and Structure

In the national approach, the researcher first divides workers into education-age cells (or more generally skill cells), which are combined in a production function at the aggregate US level. This approach then estimates the elasticity of substitution across these cells, using the relative wage response to inflows of immigrants that produced changes in relative skill supply. Borjas (2003) pioneered this approach, building on Card and Lemieux (2001). In Ottaviano and Peri (2012), we extended it, focusing on certain details and assumptions that matter in terms of results. Let's first sketch the methodology of this approach and then consider some findings.

The methodology of this approach begins by partitioning the population by education, age, and US or foreign place of birth. These characteristics are the main determinants of people's skills. Using several observations from the national data over time, it is possible to estimate the elasticity of substitution across those skill cells. However, to have enough statistical power, one has to impose a specific structure of skill complementarity that reduces the number of possible elasticity parameters. The most-used framework, for its tractability and robustness, is the nested constant elasticity of substitution (CES) structure. One common "nesting" structure divides workers into education groups to determine the first partition, and then into experience groups within education groups, and then distinguishes native and immigrant groups within experience groups.

Once elasticities are estimated using regressions, the researcher then needs to "simulate" the general equilibrium effects of immigration to account for direct competition effects (from immigrants in the same cell) and indirect complementarity effects (from immigrants in other cells). The strength of each effect is determined by the elasticity estimates, the structure of the production function, and the inflow of immigrants in each group. This approach makes clear that looking only at the reduced form regression of wages of native workers on the inflow of immigrants in that skill cell (controlling for fixed effects that capture the cross-skill complementarity effects), does not provide information on the general equilibrium effect of immigrants on wages of that group. That regression estimates a partial, relative effect, which needs to be combined with other elasticities and with the supply of immigrants by skill to obtain the wage effect on each skill group.

What are the assumptions behind this approach for identifying causality? This approach often seeks to address issues of omitted variables, like unobserved shocks in the demand for skill groups, by including fixed effects for skill (as proxied by education or experience) and time. Thus, the identifying assumption behind this approach is that, after controlling for unobserved demand changes using fixed effects, the remaining variation of immigrants by skill cell is driven by changes in their supply. The national growth of some industries or occupations that increases the demand for workers in specific skill cells (by age and education level) can threaten the identification assumption of this approach, by affecting wages and the inflow of immigrants in a cell.

Several relevant results emerge from this approach (for more discussion, see Ottaviano and Peri 2012). First, college and noncollege workers appear harder to substitute with each other than any other subgroup by age and/or finer gradations of education. The evidence suggests that it is a reasonable approximation to consider the other education and age subgroups within college and noncollege as perfectly substitutable when evaluating the general equilibrium effects of immigrants.[7] Second, considering immigrants and natives as two different groups, one finds a small but significant degree of imperfect substitution between them: immigrants in a skill group do not affect demand for native workers in the same group as negatively as they affect demand for other similar immigrants. Third, as the national capital–output ratio is rather insensitive to the yearly inflow of immigrants, it is reasonable to assume full adjustment of capital to immigration over a decade, which leads to keeping the capital intensity relatively stable during the last 40 years.

Taking these estimates, together with the relatively balanced college–noncollege distribution of immigrants during the last decades, produces small estimated wage effects of immigrants on any group of natives through the relative supply channel. One mostly obtains zero or slightly positive general equilibrium effects of immigration on wages of college and non-college native workers nationally between 1980 and 2010. In Ottaviano and Peri (2012), we analyze the effect for 1990–2006, finding in our preferred specification (table 2, column 6) an impact between (positive) 0.3 and 0.6 percent on wages of native noncollege workers and ranging from 0.3 to 1.3 percent for college-educated workers.[8] The simulated standard errors for those values are around 0.3–0.4 percent. Overall, focusing on the education-experience structure of immigrant labor supply at the national level and estimating substitutability-complementarity across skills, without accounting for adjustments in total and relative productivity and task specialization, one is left with small overall effects of immigrants on native wages of any education group.

---

[7]We have mentioned above the disagreement by Borjas, Grogger, and Hanson (2012) on this point. They argue for finer partition of schooling groups, and emphasize that the elasticity of substitution among them is imprecisely estimated in the literature and that it can vary over a large range.

[8]If one assumes instead the complementarity between high school graduate and high school dropouts preferred by Borjas (2003), immigration 1990–2006 would have a negative effect on native dropout wages (-2.0 percent) but positive on native high school graduates (+1.5 percent).

Area-Level Approach: Focus on Adjustments and Identification

Researchers have used area-level analysis to study margins of adjustment other than just wages, assuming, importantly, that native workers are not fully mobile and some of the productivity impact of immigrants remains more local. Metropolitan areas or states, and more recently "commuting zones," which are places within which people work and live, have been considered as the relevant units to analyze these effects.

Two issues need to be addressed if we want to estimate causal effects of immigration on local economies. First, the variation of immigrants across specific areas in the United States is partly driven by area-specific labor demand changes, which are imperfectly observable and can be correlated with native wage and employment growth. Indeed, there is a strong, positive, and very significant correlation between immigration and changes in native wages across local areas in the United States (as discussed in detail in Basso and Peri 2015). But even if no causal relationship exists, labor response to "booming areas" will often generate a positive correlation between wage/employment growth of natives and net immigration across areas. Thus, one needs a way to control for changes in local labor market demand, and a common approach is to use instrumental variable estimation, as will be explained below. Second, cities and regions are not closed economies and hence inflows and outflows of native workers and of firms and physical capital in response to immigration need to be considered as important margins of adjustment. These two issues do not invalidate the area analysis, which is extremely useful and informative, but have to be addressed.

The so-called "shift-share" (or enclave) instrument has become prevalent in this empirical literature, following an early intuition by Altonji and Card (1991) later developed in Card (2001). This strategy tries to isolate supply-driven changes of immigrants in local areas. It relies on the fact that, due to early circumstances related to distance from port of entry, historical accident, and preference of migrants, some areas in the United States were settled by groups of immigrants from specific countries before the surge in foreign-born that started in the 1970s. In the 1960s, for instance, Philadelphia had a large historical community of Italian immigrants, Boston was home to a large share of Irish immigrants, Los Angeles had a significant Mexican population, and San Francisco had a large Chinese community. Because of the role of immigrant networks in channeling information and assisting new arrivals, people immigrating after the 1970s were more likely to locate where a large community of co-nationals already existed. The prior distribution of immigrants in the 1960s, combined with the fact that, immigration rates boomed since the 1980s for some nationalities, such as Mexicans and Chinese, while they remained low for other groups, such as the Italians and Irish, imply very different inflows of immigrants across metropolitan areas.

The "shift-share" approach allocates total immigrants from each country proportionally to their 1970 share across US states (or metropolitan areas). In this way, researchers can exploit the aggregate surge in emigration from some countries (and not from others) and their unequal prevalence across areas in 1970 to obtain supply-driven differential growth of immigrant labor across US areas. The variation

of this shift-share instrument is driven by aggregate national and international factors that affected emigration from different countries. Hence, these factors are plausibly independent of local labor demand changes in US areas. In the first stage of this two-stage least squares approach, this instrument is used to predict immigration in US areas, hence isolating supply-driven inflows. In the second stage, using only the variation predicted for the supply-driven component, we estimate immigration's effect on native wages and employment.

It is important that the initial distribution of immigrants from each specific country is not correlated with strongly persistent area-specific demand changes; for this reason, it is often desirable to use the distribution of immigrants several years before the beginning of the period analyzed, which ideally should correspond with an immigration surge.

Using a shift-share instrument for the measurement of changes in immigration across US metropolitan areas, in Ottaviano and Peri (2006), we estimated a significant positive effect from increased immigration on labor productivity, especially if immigrants are from a variety of countries of origin. In Peri and Sparber (2009), we show that high immigration in US states produced a significant shift of native non-college-educated workers towards nonmanual occupations, complementary to immigrant specialization, with marginally positive effects on their wages. In Peri (2012), I show, and Lewis (2011) also shows, that large inflows of less-educated immigrants (usually Mexican) produced a choice of production techniques at the state or metro area level that tended to be more intensive in the use of unskilled and less-educated workers. As a consequence, the local wage of noncollege natives did not change much in response to larger immigrant supply. Taken as a group, these studies show how a combination of complementarity, productivity effects, and margins of adjustment, combined to attenuate negative effects on less-educated workers and contributed to potentially positive average wage effects on natives. These studies also found small to no significant response of employment and outward mobility of natives to an increase in immigrant supply. The adjustment to increased immigrant supply took place mainly within the area, rather than spilling over to other areas, with little impact on wages and productivity of non-college-educated.[9]

Several empirical studies of European countries that have received substantial immigration flows—such as the United Kingdom, Germany, Spain, and Italy—have also applied the area approach using shift-share instruments. Overall, the evidence

---

[9]The measure of change in labor supply due to immigration is a very important detail in calculating correlations between the growth of immigrant population and the change of native average wages (and employment) across US labor markets. The measure that should be used is the change in foreign-born workers (or hours worked) divided by the total *initial* labor force (or total hours worked). This variable captures the labor supply change in a local market due to immigrants in percentage points of the baseline labor force. The existing literature, on the contrary, often uses the *change* in *the immigrant share* of the labor force. That measure combines changes in immigrant and in native employment, building into the explanatory variable potentially spurious correlations with native wage and native employment changes. This point was discussed in Peri and Sparber (2011) and more recently in Card and Peri (forthcoming), which show that the specification with immigrants as share of labor force can be strongly biased and should be avoided.

points to small wage effects and possibly some negative employment effects on natives and a somewhat smaller response of native specialization (for example, D'Amuri and Peri 2014; Glitz 2012). Two papers, Angrist and Kugler (2003) and D'Amuri and Peri (2014), find smaller adjustment of natives and larger displacement effects of immigrants in European markets. They connect these findings with the lower labor market flexibility and higher costs of hiring and lay-offs that characterize several European countries. The interaction of the labor market impact of immigration with labor market institutions is an important area that deserves further attention.

Two other issues have been studied with particular emphasis in European countries, as they appear to be more relevant there. First, immigrants often have lower labor-market participation than natives and new immigrants seem to displace previous immigrants who are not fully integrated in the labor market (for example, Brücker and Jahn 2011). Hence their costs in terms of nonemployment may be higher than in the United States. Second, especially in Germany and in the United Kingdom, there seems to be a certain amount of "skill downgrading" of immigrants so that workers with relatively high schooling level perform jobs comparable to less-skilled natives. This is likely due to barriers created by language, licensing, and legal requirements. This phenomenon, as pointed out by Dustmann, Frattini, and Preston (2013), implies that immigrants are stronger competitors of natives whose education is lower than theirs than they are of similarly educated natives.

Two potentially important variations in the implementation of the shift-share method have recently been explored. A first variation is that rather than simply using variations in the national inflow of immigrants by country of origin, the construction of supply-driven immigrant changes has used variation in US immigration policies as source of change in immigrant flows. For example, the maximum allowed number (quota) for H-1B temporary visas issued by the United States sharply increased in 1999 and again in 2001 and then dropped in 2004. This visa program, established in 1990, has subsequently become the main channel of entry for work-related high-skilled immigrants. By interacting the aggregate H-1B visa quota, changing over years, with pre-existing distribution of foreign scientists and engineers across US metropolitan areas, Kerr and Lincoln (2010) identify a positive impact of increasing the quota on the amount of US patenting, especially for firms and cities highly dependent on foreign scientists. In Peri, Shih, and Sparber (2015), using similar variation, we identify a positive effect of skilled immigrants on wages of native college-educated workers across US metropolitan areas. We attribute this finding to local productivity growth driven by science and technology workers, who are key inputs in the invention and adoption of productivity-enhancing technologies and are largely overrepresented among skilled immigrants. The advantage of using policy variation such as the H-1B quota and its changes is that the estimates of these effects are more directly translated into policy evaluations. The main identifying assumption of this approach is that no metropolitan area is large enough to drive national policies: to the extent that the aggregate variation in immigration policies is independent of specific productivity changes of metropolitan areas, the estimates of local effects can be viewed as causal.

The second recent variation is that when using the shift-share instrument, researchers increasingly perform a validity check. This is aimed at establishing that, in the initial year, the distribution of country-specific foreign-born people across US areas, and hence the instrument itself is not correlated with pre-period economic trends in those areas.[10] That is, in the year chosen as the initial year, the share of foreign-born should not predict the change in native wages and employment before the analyzed period. For instance, in the United States, the year 1970 might be chosen as the initial year, as the immigration reform of 1965 started a long-trend increase in immigration (and census data are available for 1970). Hence, one should ascertain that a shift-share instrument constructed starting in 1970 for US labor markets (as measured by commuting zones or metropolitan statistical areas) is not correlated to the pre-1970 growth of wages and employment. In some European countries such as Spain, where immigration surged in the 2000s, the year 2000 might be chosen as the initial year. This validity test has only been applied fairly recently, in part because it can be tricky in some cases. One needs a clear period of immigration growth (or growth in a specific group of immigrants) considered as the "event period" that follows little or no immigration (the pre-event period). In decades of steady growth of foreign-born, or when there is no clear starting point for the phenomenon, it may be hard to identify such a pre-immigration period.

In Peri, Shih, and Sparber (2015), we show that the share of foreign-born workers in science, technology, engineering, and mathematics jobs across US metro areas in 1980 was not related to pre-1980 wage growth, but it was strongly related to growth in these jobs in the 1990s and 2000s after the H-1B visa program (which started in 1990) allowed larger inflow of these science and technology workers. In this case, the identified "high-skilled immigration period" is the 1990–2010 period, beginning with the introduction of the H-1B visa program. This finding is consistent with the idea that the shift-share instrument proxies for a supply-driven shock and is not correlated with persistent and pre-existing demand trends.

Analyzing Quasi-Experiments: What Do We Learn from Sudden Inflows?

In some circumstances, usually driven by sudden eruption of wars or abrupt changes in policies or regimes, a large and sudden flow of migrants—often refugees—arrive at a specific destination in a short window of time. In these situations, the arrival of these migrants was not the consequence of changes in economic conditions in the receiving country and often immigrants did not choose the area of settlement based on economic considerations.

Thus, these episodes approximate sudden shifts in immigrant labor supply and can be used to identify a short-run causal impact of increased immigrant supply. The econometric approach to studying these quasi-experiments typically applies a difference-in-differences method, considering the "treatment" to be the sudden

---

[10]The concern that past and persistent area-specific trends may affect past inflow of immigrants as well as local economic performance was first formulated in Borjas, Katz, and Freeman (1997) as they cautioned against the risks of the area approach in assessing labor market effects of immigrants.

inflow of immigrants (or refugees) into one or more local areas and choosing an appropriate control group to evaluate the impact of the treatment relative to outcomes in such a control group.

Between May and September 1980, about 120,000 Cubans left from the port of Mariel to reach the United States, as consequence of a sudden and temporary lift of the travel ban by the Castro regime in Cuba. About half of them arrived in Miami. The event was sudden, very limited in time, and not accompanied by economic crises in Cuba. Hence the Miami economy was receiving many refugees because of its pre-existing Cuban community but was unaffected by the other forces related to the Cuban outflow. This episode was first analyzed by Card (1990), who compared Miami to four control cities chosen as roughly similar to Miami in terms of black and Hispanic employment percentages and pre-1979 labor market trends. He found negligible effects on average wages and on wage dispersion in Miami relative to the control cities after 1980.

In Peri and Yasenov (2015), we revisited the Mariel boatlift episode, using the "synthetic control" method. For this method, the control group is the combination of metropolitan areas (among 44 whose data are available) that minimize the difference in some labor market variables over the 1972–1979 (pre-event) period between this control group and Miami. Because the refugees were mainly unskilled, we focus on the group of non-Cuban high school dropouts aged 19–65, the group more likely to compete with the new immigrants. While the imprecision of the estimates is large, the treatment-control difference after the Mariel boatlift actually shows a positive effect on the wages of native unskilled labor one, two, and three years after the event. However, as Figure 6A shows, the results are well within the range of simulated treatment-control differences, which capture the idiosyncratic variation in the sample, and hence no clear evidence of any wage effect is shown in the analysis.[11]

In another example of quasi-experimental variation, in Foged and Peri (2016), we analyzed the impact of the surge in refugees to Denmark from the war zones of Bosnia, Somalia, Afghanistan, and Iraq (in turn) during the period from the Bosnian crisis of 1994 to the Great Recession of 2008. The approach is to compare municipalities that were refugee-receiving (treated) and not refugee-receiving (control). The identification strategy is particularly clean in this case, because under Denmark's refugee-dispersal policy between 1986 and 1998, all refugees were dispersed without knowledge of their characteristics and quasi-randomly across municipalities; hence some municipalities happened to receive more Bosnians or Afghans or Somalis or Iraqis than others. The inflows of refugees were modest up to 1994. But, beginning in 1994, a large flow of refugees from Bosnia began (driven by the Balkan war), and

---

[11] Work on the Mariel boatlift is ongoing. For example, Borjas (2015) shows larger negative effects on wages after the boatlift in some subgroups (white, males, and non-young). However, this work uses different data: specifically, it uses the March Current Population Survey, while in Peri and Yasenov (2015), we use the Outgoing Rotation Group of the Current Population Survey. The March CPS sample is much smaller than the ORG-CPS, and thus statistically less reliable. It shows large imprecision, sensitivity to sample selection, huge year-to-year variation, and extremely large standard errors.
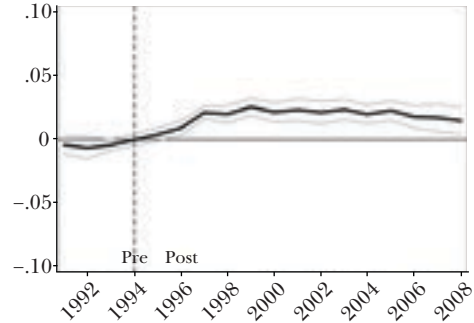
Figure 6

**Treatment-Control Differences in Native Low-Skilled Logarithm of Hourly Wages
in Two Quasi-Experiments**

A: Miami minus Synthetic Control
(includes simulated range from
44 metro areas, 1972–1991)
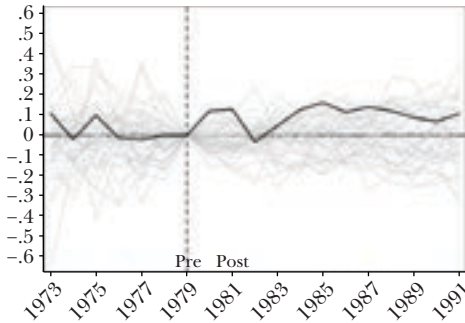
B: Danish Municipalities with High Refugee Inflows
minus Those with Low Refugee Inflows (includes
95% confidence interval, Denmark 1991–2008)

Source: Figure 6A represents author's adjustment of a figure in Peri and Yasenov (2015). Figure 6B uses
the author's elaboration on estimates from Foged and Peri (2016).
Notes: Each graph shows differences in treatment-control log(wages) before and after the event, marked
with a vertical line. In panel A, the thick line represents the wage difference between Miami and Control
and the other lines represent the simulated differences for 44 other cities, providing the range of possible
variation for the constructed statistic. In Panel B, the thick line represents the estimated difference and
the two thinner lines delimit the 95 percent confidence interval.

the dispersal policy was revoked after few years. As a result, refugees from different
nationalities started clustering where an existing community of co-nationals already
existed, generating differential flows. These flows are quasi-randomly distributed,
as they follow the initial dispersal pattern. Moreover, Denmark has administrative
longitudinal data of the full population. Thus, we can track the wage and occupa-
tion for every single Danish individual over time; for example, we can track workers
who lived as of 1994 in municipalities highly impacted by refugees even if they
moved elsewhere. For the pre-1994 period, there was no significant difference or
trend differential in the hourly wage of native workers between treated and control
Danish municipalities. After 1994, a positive difference slowly emerged and persisted
for native less-educated workers in the municipalities that had received more immi-
grants. This treatment-control difference in wages of the less educated between
1991 and 2008 is shown in Figure 6B. The explanation for this wage increase is that
native low-skilled workers made a transition towards less manual and more complex
(communication- and cognitive-intensive) occupations in response to the inflow of
refugees, who specialized in manual jobs, and this increased their wages.

Of course, like all quasi-experiments, the Danish event analyzed here can only
be generalized with caution. The larger refugee inflow starting in 1994 was distrib-
uted over time and not excessively large at any single moment (overall it increased

the labor force of the treated municipalities by 2 percentage points relative to the control). It was smaller and not as sudden relative to the Mariel boatlift, allowing for the operation of adjustment on the margin. But on the other side, the sample size of the Danish data is vastly larger than the Mariel data. Moreover, the Danish data is of high quality and it follows the universe of Danish workers for 18 years, which allows an assessment of the long-run impact of low-skilled immigration through adjustment and transitions of less-educated native workers.

Studies using quasi-experimental data seem quite worthwhile, but broader lessons must be drawn with care because these sudden episodes may miss important parts of the medium- and long-run effects of immigration. In particular, five important features limit what we can learn from sudden flows of refugees. First, these episodes are rare and not representative of typical patterns of migration to high-income countries, which occur at slower and more predictable rates and are largely driven by economic motivations. As a consequence, these unexpected episodes often allow less time for adjustment on the margins, and their short-run effect may be larger than for expected episodes. Second, the type of immigrants in these episodes may be significantly less "labor market ready" than the average immigrant because they are more likely to be coming from wars and from refugee camps. Third, the suddenness of the episodes does not necessarily guarantee exogeneity of the distribution of immigrants, in which case identification of causal effects may be problematic. For instance, Hunt (1992) studied repatriates from African colonies to France, and Carrington and de Lima (1996) studied repatriates to Portugal, but those returnees could choose their destination region and hence omitted variable bias can be significant. Fourth, proximity to a crisis or to a war-ridden country of origin may affect local labor markets in the receiving country through other channels, including disruption of trade, reduced capital movements, and fear of conflict, which would in turn affect labor markets in receiving countries for reasons not directly related to the arrival of immigrants. As an example, a recent study of Syrian refugees in Turkey may suffer from this issue (Ceritoglu, Gurcihan Yuncular, Torun, and Tumen 2015). Finally, these quasi-experimental episodes often involve only a handful of regions or cities receiving a large and sudden inflow of immigrants—the Mariel boatlift was focused on immigrant arrivals in a single city—and hence broader and precise inference can be problematic.

Discussion and Conclusions: Promising Research Avenues

Research on immigration continues to grow, including areas of research not discussed in this study involving the economic determinants of migration and the impact on countries of origin. Limiting the discussion to immigration's effect on labor markets and on productivity, I see three important and promising areas of research that may become increasingly relevant.

First, closer attention to the details of immigration policies and to their variations should be combined with the availability of longitudinal data on individual workers and firms. Some research on US immigration involving the timing

of changes in the total number of H-1B visa was mentioned earlier. Other US policy changes that seem worthy of investigation include the regularization of undocumented immigrants that followed the Immigration Reform and Control Act 1986, or changes in the rules allocating permits to hire some type of foreign workers (such as lotteries held in 2008 and 2009 to allocate H-1B visas to employers). Many European countries have rules, which change from time to time, about foreign workers and refugees and how they will be distributed and how the undocumented obtain legal status. Focusing on the specific nature and timing of policy changes and relying on administrative data that are increasingly available for European countries and the United States, we can significantly improve our understanding of the consequences of specific immigration policies on the labor market outcomes of natives and immigrants over the short and long runs.

Second, the effects of immigration on labor markets and on outcomes for native workers seem likely to interact with the flexibility and openness of labor market policies in a country, including rules about unionization and collective bargaining, protections for incumbent workers, and policies that seek to smooth labor market adjustment costs. While the United States has relatively pro-competitive and flexible labor markets, European countries vary substantially among themselves both in the presence of immigrants and in terms of their labor market policies and institutions. Thus, European countries seem to offer an interesting laboratory to study how labor market policies affect the impact and the absorption of immigrants.

Developing this point a step further, the general equilibrium analysis of immigration can be advanced also using models with frictions in labor markets (including search models) and ultimately embedding them into macroeconomic models. It seems plausible that immigration policies can have meaningful macro effects on labor and productivity, as well as on consumption and perhaps also redistribution. For instance, Chassamboulli and Palivos (2014) introduce immigration effects on the margin of job creation by firms, which generates a complementarity between immigrants and job creation. In Chassamboulli and Peri (2015), we use a general equilibrium model with search in labor markets to analyze the employment consequences of policies reducing the number of undocumented immigrants. Battisti, Felbermayr, Peri, and Poutvaara (2014) extend the search model of labor markets with immigrants to an economy with unemployment benefits and fiscal redistribution. One can readily imagine micro-based estimates of specific parameters used as building blocks in macroeconomic models that produce aggregate predictions for immigration policies going beyond the simple aggregate production function.

Third, there is a growing interest in the analysis of foreign students because they are the fastest-growing group of foreign-born. Tertiary education seems likely to be a sector of significant growth for jobs, value-added, and (service) exports for the US economy. Foreign students increase the demand for these services and, once they graduate with a US degree, they are often well-positioned to be productive workers and professionals. Hence US tertiary education services can be a sector in which foreign-born boost demand (as students) and supply (as researchers/professors) with potentially important contributions to US human capital and to local economies.

Related to this theme, immigration of scientists and engineers, especially at the very top of the ability distribution, also deserves more specific attention. Among the US-based Nobel laureates in Medicine, Physics, and Chemistry during the last 10 years, 17 out of 33 were foreign-born. Top science institutions have potentially large effects on innovation and growth for the whole world, which in turn implies that the mobility of top-skilled workers towards the poles of innovation (most of them in the United States) could be contributing to global science and global growth. The connection between high-skilled immigrants, and technological and scientific progress, as it affects the demand for more-skilled immigration, is not well understood but is likely to be a very important engine of growth in the long run.

References

Acemoglu, Daron. 2002. "Directed Technical Change." *Review of Economic Studies* 69(4): 781–809.

Altonji, Joseph G., and David Card. 1991. "The Effects of Immigration on the Labor Market Outcomes of Less-skilled Natives." In *Immigration, Trade, and the Labor Market*, edited by John M. Abowd and Richard B. Freeman, 201–34. University of Chicago Press.

Angrist, Joshua D., and Adriana D. Kugler. 2003. "Protective or Counter-Productive? Labour Market Institutions and the Effect of Immigration on EU Natives." *Economic Journal* 113(488): F302–F331.

Autor, David H. 2015. "Why Are There Still So Many Jobs? The History and Future of Workplace Automation." *Journal of Economic Perspectives* 29(3): 3–30.

Autor, David H., Lawrence F. Katz, and Melissa S. Kearney. 2008. "Trends in U.S. Wage Inequality: Revising the Revisionists." *Review of Economics and Statistics* 90(2): 300–323.

Barro, Robert J., and Jong-Wha Lee. 2013. "A New Data Set of Educational Attainment in the World, 1950–2010." *Journal of Development Economics* 104: 184–98.

Basso, Gaetano, and Giovanni Peri. 2015. "The Association between Immigration and Labor Market Outcomes in the United States." IZA

Discussion Paper 9436, Institute for the Study of Labor (IZA).

Battisti Michele, Gabriel Felbermayr, Giovanni Peri, and Panu Poutvaara. 2014. "Immigration, Search, and Redistribution: A Quantitative Assessment of Native Welfare." NBER Working Paper 20131.

Borjas, George J. 1995. "The Economic Benefits from Immigration." *Journal of Economic Perspectives* 9(2): 3–22.

Borjas, George J. 2003. "The Labor Demand Curve *is* Downward Sloping: Reexamining the Impact of Immigration on the Labor Market." *Quarterly Journal of Economics* 118(4): 1335–74.

Borjas, George J. 2015. "The Wage Impact of the Marielitos: A Reappraisal." NBER Working Paper 21588.

Borjas, George J., Jeffrey Grogger, and Gordon H. Hanson. 2012. "Comment: On Estimating Elasticities of Substitution." *Journal of the European Economic Association* 10(1): 198–210.

Borjas, George J., Lawrence F. Katz, and Richard B. Friedman. 1997. "How Much Do Immigration and Trade Affect Labor Market Outcomes?" *Brookings Papers on Economic Activity* no. 1, pp. 1–90.

Brücker, Herbert, Stella Capuano, and Abdeslam Marfouk. 2013. "Education, Gender

and International Migration: Insights from a Panel-Dataset 1980–2010." Unpublished paper.

Brücker Herbert, and Elke J. Jahn. 2011. "Migration and Wage-Setting: Reassessing the Labor Market Effects of Migration." *Scandinavian Journal of Economics* 113(2): 286–317.

Card, David. 1990. "The Impact of the Mariel Boatlift on the Miami Labor Market." *Industrial and Labor Relations Review* 43(2): 245–57.

Card, David. 2001. "Immigrant Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration." *Journal of Labor Economics* 19(1): 22–64.

Card, David. 2009. "Immigration and Inequality." *American Economic Review* 99(2): 1–21.

Card David, and Thomas Lemieux. 2001. "Can Falling Supply Explain the Rising Return to College for Younger Men? A Cohort-Based Analysis." *Quarterly Journal of Economics* 116(2): 705–746.

Card, David, and Giovanni Peri. Forthcoming. "Immigration Economics: A Review." *Journal of Economic Literature.*

Carrington, William J., and Pedro J. F. de Lima. 1996: "The Impact of 1970s Repatriates from Africa on the Portuguese Labor Market." *Industrial and Labor Relations Review* 49(2): 330–47.

Ceritoglu, Evren, H. Burcu Gurcihan Yunculer, Huzeyfe Torun, and Semih Tumen. 2015. "The Impact of Syrian Refugees on Natives' Labor Market Outcomes in Turkey: Evidence from a Quasi-Experimental Design." MPRA Paper 61503, Munich Personal RePEc Archive, University Library of Munich, Germany.

Chassamboulli Andri, and Theodore Palivos. 2014. "A Search-Equilibrium Approach to the Effects of Immigration on Labor Market Outcomes." *International Economic Review* 55(1): 111–29.

Chassambouli, Andri, and Giovanni Peri. 2015. "The Labor Market Effects of Reducing the Number of Illegal Immigrants." *Review of Economic Dynamics* 18(4): 792–821.

Ciccone, Antonio, and Robert E. Hall. 1996. "Productivity and the Density of Economic Activity." *American Economic Review* 86(1): 54–70.

Clemens, Michael A. 2014. "Does Development Reduce Migration?" IZA Discussion Papers 8592, Institute for the Study of Labor (IZA).

Cortés, Patricia. 2008. "The Effect of Low-Skilled Immigration on US Prices: Evidence from CPI Data." *Journal of Political Economy* 116(3): 381–422.

Cortés, Patricia, and José Tessada. 2011. "Low-Skilled Immigration and the Labor Supply of Highly Skilled Women." *American Economic Journal: Applied Economics* 3(3): 88–123.

D'Amuri, Francesco, and Giovanni Peri. 2014.

"Immigration, Jobs, and Employment Protection: Evidence from Europe Before and During the Great Recession." *Journal of the European Economic Association* 12(2): 432–64.

Diamond, Rebecca. 2016. "The Determinants and Welfare Implications of US Workers' Diverging Location Choices by Skill: 1980–2000." *American Economic Review* 106(3): 479–524.

di Giovanni, Julian, Andrei A. Levchenko, and Francesc Ortega. 2015. "A Global View of Cross-Border Migration." *Journal of the European Economic Association* 13(1): 168–202.

Docquier, Frederic, and Abdeslam Marfouk. 2004. "Measuring the International Mobility of Skilled Workers (1990–2000): Release 1.0." Policy Research Working Paper 3381, World Bank.

Docquier, Frédéric, Olivier Lohest, and Abdeslam Marfouk. 2005. "Brain Drain in Developing Regions (1990–2000)." IZA Discussion Papers 1668, Institute for the Study of Labor (IZA).

Docquier Frédéric, Çağlar Ozden, and Giovanni Peri. 2014. "The Labour Market Effects of Immigration and Emigration in OECD Countries." *Economic Journal* 124(579): 1106–45.

Dustmann Christian, Tommaso Frattini, and Ian P. Preston. 2013. "The Effect of Immigration along the Distribution of Wages." *Review of Economic Studies* 80(1): 145–73.

Ellison Glenn, Edward L. Glaeser, and William R. Kerr. 2010. "What Causes Industry Agglomeration? Evidence from Coagglomeration Patterns." *American Economic Review* 100(3): 1195–1213.

Foged, Mette, and Giovanni Peri. 2016. "Immigrants' Effect on Native Workers: New Analysis on Longitudinal Data." *American Economic Journal: Applied Economics* 8(2): 1–34.

Friedberg, Rachel M., and Jennifer Hunt. 1995. "The Impact of Immigrants on Host Country Wages, Employment and Growth." *Journal of Economic Perspectives* 9(2): 23–44.

Glitz, Albrecht. 2012. "The Labor Market Impact of Immigration: A Quasi-Experiment Exploiting Immigrant Location Rules in Germany." *Journal of Labor Economics* 30(1): 175–213.

Goldin, Claudia, and Lawrence Katz. 2008. *The Race between Education and Technology.* Harvard University Press.

Greenstone, Michael, Richard Hornbeck, and Enrico Moretti. 2010. "Identifying Agglomeration Spillovers: Evidence from Winners and Losers of Large Plant Openings." *Journal of Political Economy* 118(3): 536–98.

Grogger, Jeffrey, and Gordon H. Hanson. 2011. "Income Maximization and the Selection and Sorting of International Migrants." *Journal of Development Economics* 95(1): 42–57.

Grossman, Gene M., and Esteban Rossi-

Hansberg. 2008. "Trading Tasks: A Simple Theory of Offshoring." *American Economic Review* 98(5): 1978–97.

Hunt, Jennifer. 1992. "The Impact of the 1962 Repatriates from Algeria on the French Labor Market." *Industrial and Labor Relations Review* 45(3): 556–72.

Hunt, Jennifer. 2012. "The Impact of Immigration on the Educational Attainment of Natives." NBER Working Papers 18047.

Hunt, Jennifer, and Marjolaine Gauthier-Loiselle. 2010. "How Much Does Immigration Boost Innovation?" *American Economic Journal: Macroeconomics* 2(2): 31–56.

Iranzo, Susana, and Giovanni Peri. 2009. "Schooling Externalities, Technology, and Productivity: Theory and Evidence from U.S. States." *Review of Economics and Statistics* 91(2): 420–31.

Kerr, William R., and William F. Lincoln. 2010. "The Supply Side of Innovation: H-1B Visa Reforms and U.S. Ethnic Invention." *Journal of Labor Economics* 28(3): 473–508.

Lewis, Ethan. 2011. "Immigration, Skill Mix, and Capital Skill Complementarity." *Quarterly Journal of Economics* 126(2): 1029–69.

Lewis Ethan, and Giovanni Peri. 2015. "Immigration and the Economy of Cities and Regions." In *Handbook of Regional and Urban Economics*, vol. 5A, edited by Gilles Duranton, J. Vernon Henderson, and William C. Strange, 625–85. UK: North Holland.

Manacorda, Marco, Alan Manning, and Jonathan Wadsworth. 2012. "The Impact of Immigration on the Structure of Wages: Theory and Evidence from Britain." *Journal of the European Economic Association* 10(1): 120–51.

Melitz, Marc J. 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71(6): 1695–1725.

Moretti, Enrico. 2004a. "Estimating the Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data." *Journal of Econometrics* 121(1–2): 175–212.

Moretti, Enrico. 2004b. "Workers' Education, Spillovers, and Productivity: Evidence from Plant-Level Production Functions." *American Economic Review* 94(3): 656–90.

Moretti, Enrico, and Per Thulin. 2013. "Local Multipliers and Human Capital in the United States and Sweden." *Industrial and Corporate Change* 22(1): 339–62.

Ortega, Francesc, and Giovanni Peri. 2013. "The Effect of Income and Immigration Policies on International Migrations." *Migration Studies* 1(1): 47–74.

Ortega, Francesc, and Giovanni Peri. 2014. "Openness and Income: The Roles of Trade and Migration." *Journal of International Economics* 92(2): 231–51.

Ottaviano, Gianmarco I. P., and Giovanni Peri. 2006. "The Economic Value of Cultural Diversity: Evidence from US Cities." *Journal of Economic Geography* 6(1): 9–44.

Ottaviano, Gianmarco I. P., and Giovanni Peri. 2012. "Rethinking the Effect of Immigration on Wages." *Journal of the European Economic Association* 10(1): 152–97.

Peri, Giovanni. 2012. "The Effect of Immigration on Productivity: Evidence from U.S. States." *Review of Economics and Statistics* 94(1): 348–58.

Peri, Giovanni, and Chad Sparber. 2009. "Task Specialization, Immigration, and Wages," *American Economic Journal: Applied Economics* 1(3): 135–69.

Peri, Giovanni, Kevin Shih, and Chad Sparber. 2015. "STEM Workers, H-1B Visas, and Productivity in US Cities." *Journal of Labor Economics* 33(S1, Part 2): S225–S255.

Peri, Giovanni, and Chad Sparber. 2011. "Assessing Inherent Model Bias: An Application to Native Displacement in Response to Immigration." *Journal of Urban Economics* 69(1): 82–91.

Peri, Giovanni, and Vasil Yasenov. 2015. "The Labor Market Effects of a Refugee Wave: Applying the Synthetic Control Method to the Mariel Boatlift." NBER Working Papers 21801.

Roy, A. D. 1951. "Some Thoughts on the Distribution of Earnings." *Oxford Economic Papers*, New Series, 3(2): 135–46.

Saiz, Albert. 2007. "Immigration and Housing Rents in American Cities." *Journal of Urban Economics* 61(2): 345–71.

Trax, Michaela, Stephan Brunow, and Jens Suedekum. 2012. "Cultural Diversity and Plant-Level Productivity." CReAM Discussion Paper no. 23/12, Centre for Research and Analysis of Migration (CReAM), Department of Economics, University College London.

United Nations. 2015. "International Migration Flows to and from Selected Countries: The 2015 Revision." A dataset. United Nations, Department of Economic and Social Affairs, Population Division, New York. http://www.un.org/en/development/desa/population/migration/data/empirical2/migrationflows.shtml.

World Bank. 2012. "World Development Indicators." Washington, DC: World Bank. http://data.worldbank.org/data-catalog/world-development-indicators.