THE IMPACT OF MASS MIGRATION ON THE ISRAELI LABOR MARKET*

RACHEL M. FRIEDBERG

Immigration increased Israel's population by 12 percent between 1990 and 1994, after emigration restrictions were lifted in an unstable Soviet Union. Following the influx, occupations that employed more immigrants had substantially lower native wage growth and slightly lower native employment growth than others. However, because the immigrants' postmigration occupational distribution was influenced by relative labor market conditions across occupations in Israel, Ordinary Least Squares estimates of the immigrants' impact on those conditions are biased. Instrumental Variables estimation, exploiting information on the immigrants' former occupations abroad, suggests no adverse impact of immigration on native outcomes.

I. INTRODUCTION

Over the last decade, Israel has experienced an immigration of massive proportions from the former Soviet Union. Close to one million Russian immigrants have come to the country since 1989, increasing the population by over 7 percent in the space of just two years, and by 12 percent in the first half of the 1990s. The aim of this paper is to use this natural experiment to analyze the impact of immigration on the receiving labor market. In particular, the goal is to determine whether there have been adverse effects on the labor market outcomes of the "native" Israeli population.[1]

There has been much research recently into the question of how immigration affects the labor market outcomes of natives. In the simplest supply and demand model of the labor market, immigration causes an outward shift in the labor supply curve.[2]

* Funding from the Falk Institute is gratefully acknowledged. Data were provided by the Social Sciences Data Archive at the Hebrew University of Jerusalem. Vadim Marmer provided outstanding research assistance. I thank Joshua Angrist, Moshe Buchinsky, Jennifer Hunt, Lawrence Katz, and seminar participants at Hebrew University, Tel Aviv University, the Bank of Israel, Brown University, Yale University, Boston College, the Massachusetts Institute of Technology, Harvard University, Princeton University, the Population Association of America, the National Bureau of Economic Research, Boston University, Rutgers University, and University of Rochester for helpful comments.

1. The terms "Israelis" and "natives" will be used to refer to veteran Israelis, whether born in Israel or abroad. The terms "Russians" and "immigrants" will be used to refer to the recent immigrants from Russia and other parts of the former Soviet Union.

2. Immigration may also cause an outward shift in the labor demand curve, but this is typically assumed to be of a smaller magnitude, particularly in the

The Quarterly Journal of Economics, November 2001

Assuming imperfectly elastic labor supply and demand curves, equilibrium wages will fall, and equilibrium employment will rise, but by less than the size of the immigration. Immigrants will therefore displace some natives in employment. However, despite the popular belief that immigrants have a large adverse impact on the wages and employment opportunities of the native-born population, the research in this area is not largely supportive of that conclusion (see Borjas [1994], Friedberg and Hunt [1995], and LaLonde and Topel [1997] for reviews of the literature). Estimated employment effects are quite weak, and there is not a consensus as to the size of immigration's impact on wages. Most studies have found that a 10 percent increase in the fraction of immigrants in the population reduces native wages by 1 percent at most.[3]

Previous empirical work has followed three major approaches. Studies exploiting geographic variation correlate immigration and changes in native outcomes across cities or regions [Altonji and Card 1991; Goldin 1994; LaLonde and Topel 1991; Pischke and Velling 1997]. National factor proportions analyses calculate the changes in the supply of different skill groups implied by immigration and combine them with estimates of labor demand elasticities to gauge the change in native wages [Borjas, Freeman, and Katz 1992, 1996, 1997; Jaeger 1996]. This approach yields more sizable effects of immigration than the geographic approach. Finally, studies of natural experiments analyze migrations induced by political factors in the sending country [Card 1990; Hunt 1992; Carrington and DeLima 1996]. These studies have not found a significant effect of immigration on native outcomes.[4]

short run or by sector. In a model of wage differentials, if immigrants and natives have different skill distributions, but similar consumption bundles, immigration shifts the relative supply curves of certain groups of workers, with little or no change in the relative demand curves. This textbook model assumes that workers are perfect substitutes. Native workers who are, in fact, gross complements with immigrant labor should experience a rise in both wages and employment as a result of immigration.

3. Aspects of some of the empirical approaches would suggest that these estimated elasticities probably overstate the true effect, although recent work by Borjas, Freeman, and Katz [1996] argues that the impact is in fact understated in much of the literature, due to factor price equalization across localities within a country. They argue that because factors are quite mobile within countries but not across them, national labor markets are the proper level of aggregation for assessing the (medium-run) impact of immigration.

4. Empirical research on the Russian mass migration to Israel has focused on the labor market adjustment of the new immigrants themselves, rather than their

In this paper I provide new evidence on immigration's impact on the host labor market, using an approach that combines use of a natural experiment with a novel instrumental variable which exploits detailed data on immigrants' occupations in their country of origin. The Instrumental Variables results do not support the view that immigrants adversely affect the earnings and employment opportunities of native workers.

There are four reasons why the Russian migration to Israel makes a particularly interesting case study of immigration's impact on the receiving labor market. First, this wave of immigration was large and concentrated. In 1990 alone, Russian immigration led to population growth of 4 percent in Israel, with an average annual rate of 1.4 percent sustained over the seven-year period 1989–1995. No immigration to the United States or Western Europe has been comparable in magnitude. At the peak of mass migration to the United States at the beginning of the century, the rate of population growth due to immigration was 1 percent per year, and U. S. immigration is still considered an important issue by economists and policy-makers at its current rate of only about 0.35 percent per year.

Second, this case provides an exogenous source of variation for studying the effects of immigration on the labor market. The migration was precipitated by the lifting of emigration restrictions in the Soviet Union. Due to the unstable political and economic climate there, the majority of the Jewish community chose to emigrate. They chose to leave because of conditions in the former Soviet Union, and, in most cases, they went to Israel simply because it was their only immediate option. Unlike other potential host countries, Israel imposed no entry restrictions and no waiting period.

Third, Israel is a very small country. For most purposes, it may be considered to be a single labor market. The inability of many studies to detect an impact of immigration on labor market

impact on native outcomes [Beenstock and Ben Menahem 1995; Eckstein and Shachar 1995; Flug and Kasir 1993; Flug, Kasir, and Ofer 1992; Weiss, Sauer, and Gotlibovski 1999]. An exception is Hercowitz and Yashiv [1999], which estimates an aggregate time-series model that implies a temporary negative impact on native employment after a year and a half. Theoretical research has explored the potential effects of this wave on macroeconomic variables such as growth, aggregate unemployment, and the aggregate returns to labor and capital [Beenstock and Fisher 1997; Brezis and Krugman 1996; Flug, Hercowitz, and Levi 1994; Hercowitz and Meridor 1991, 1993; Hercowitz, Kantor, and Meridor 1993; Weiss and Ben David 1994].

outcomes in the United States and Europe may be due to a diffusion of immigration's local effects through factor price equalization with a large unaffected geographic area. In Israel this problem is not present.

The final reason that this case is of particular interest is the unusual skill composition of the new immigrants from Russia. Virtually all of the existing literature in this area has studied inflows of workers less-skilled than the average native. The Russian immigrants to Israel are highly educated and have come with a good deal of labor market experience. While the short-run impact may be the same, the reaction of the labor market in the long run to an inflow of highly educated immigrants may be different from its reaction to one with less human capital.[5]

The next section of the paper provides some background on the evolution of immigration and labor market conditions in Israel. Section III discusses theoretical predictions of the impact of immigration on the earnings of native workers. The econometric framework for the empirical analysis is laid out in Section IV, and the data and variables used are described in Section V. Section VI reports the empirical findings and discusses the contrast between the OLS and IV estimates. The final section concludes.

II. Background

Beginning with the pre-State waves of migration and culminating in the mass migrations from Europe and the Arab World following Independence in 1948, Israel has been a country characterized by a high level of immigration. Currently, approximately half of the population is foreign-born. Immigration to Israel in the period 1980–1995 is presented in Figure I. Through most of the 1980s, approximately one thousand immigrants arrived per month. At the end of 1989, immigration rose sharply, with the beginning of the mass migration from Russia. At the

5. For example, since many immigrants lack the language skills needed to work in their professions upon arrival, it may be that they initially compete with less-skilled natives for blue-collar jobs. As they assimilate, they may move out of that sector and begin to compete at the high-skill end of the labor market. For this reason, the impact in certain (low-skill) sectors may dissipate, and in other (high-skill) sectors may occur only with a lag, but display more persistence. That persistence will be mitigated, to the extent that the concentration of highly educated labor (e.g., medical doctors, engineers, etc.) attracts capital in the long run. Research on this pattern must await the long run.

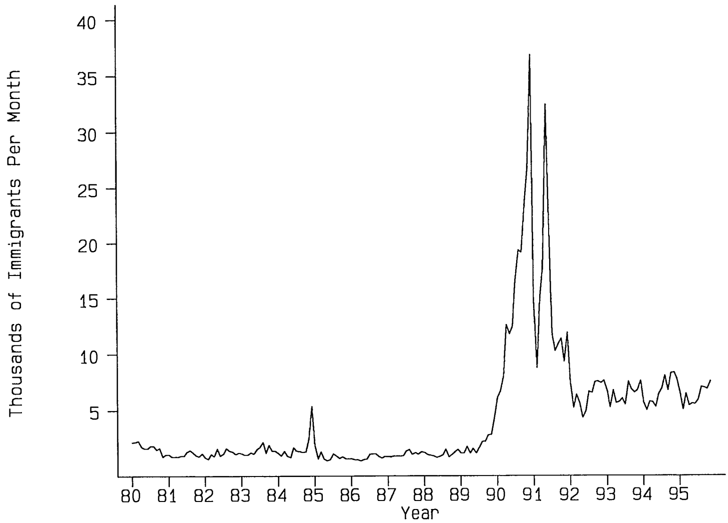

FIGURE I
Immigration to Israel

Note: Number of immigrants, including immigrating citizens, per month. Sources are Bank of Israel [1999] and Israeli Central Bureau of Statistics [1997].

peak of the wave, 36,000 Russians immigrated to Israel in a single month. The temporary drop in early 1991 was due to the Persian Gulf War. From 1989 to 1995, 610,100 immigrants arrived from the former Soviet Union, increasing the size of the Israeli population by 13.6 percent.

The time-series of real wages and the unemployment rate in Israel for 1980–1995 are displayed in Figure II. Casual observation suggests that the changes in wages which occurred over this period are consistent with a large increase in labor supply. With the exception of the recession of 1982 and the hyperinflation and stabilization of 1984–1985, real wages grew rapidly through the 1980s. Beginning in 1989, however, the real wage began a three-year decline, followed by only slow growth for the rest of the period.

High unemployment rates at the beginning of the 1990s are also consistent with the arrival of large numbers of immigrants. However, the timing indicates that the increase was at least partly due to other causes. The rise in unemployment began in mid-1988, preceding the immigration by more than a year. It is also notable that by 1994, the unemployment rate had already

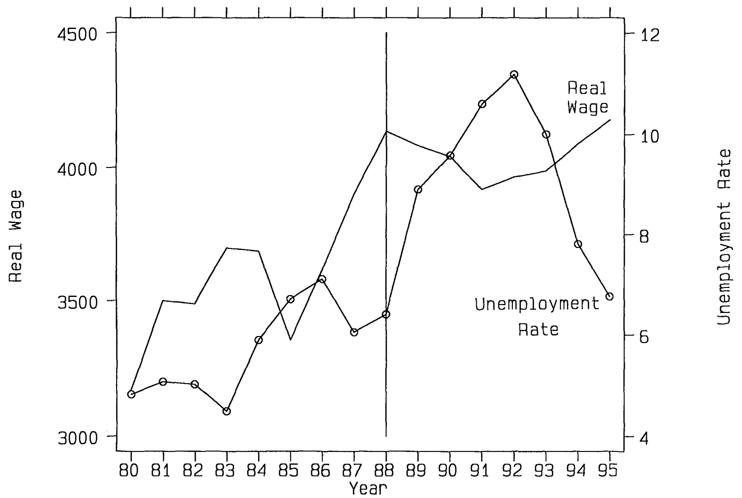

FIGURE II
Aggregate Labor Market Conditions

Note: Variables are the average real wage per employee and the unemployment rate, derived from the Labour Force Survey. Source is Bank of Israel [1997, 1999].

fallen to a level lower than at the beginning of the mass migration.

While these wage and unemployment patterns are suggestive, caution must be taken in their interpretation. First, the aggregate real wage and unemployment rate series in Figure II are composites of the respective averages for the new immigrants and the native population. Since new immigrants earn less and have higher unemployment rates than natives, the changes in these labor market variables could partly reflect a change in the composition of the labor force, rather than any impact of immigration on the labor market outcomes of natives. Estimates of the wage and unemployment rate gaps between natives and the new immigrants, however, point to this composition effect being quite small (see Beenstock and Ben Menahem [1995], Eckstein and Shachar [1995], Flug and Kasir [1993], Flug, Kasir, and Ofer [1992], and Weiss, Sauer, and Gotlibovski [1999]). In the empirical analysis below, the problem of distinguishing composition from impact effects will be eliminated through the use of microdata on native Israelis alone.

A second caveat to drawing conclusions from simple time-series is that the Russian immigration was by no means the only major macroeconomic event in Israel during this time period. Other major events included the Palestinian uprising (or "Intifada"), which began in 1987, the Persian Gulf War in 1991, and the signing of the Oslo peace accords in 1993. For this reason, any analysis will obviously require sources of variation other than time. The analysis below will focus on changes in relative wages and employment across occupations, exploiting the fact that the occupational composition of the Russian immigrants is different from that of the native Israeli population.

III. Theory

Before examining the data, it is useful to consider what impact conventional models predict immigration will have on the labor market outcomes of natives (Johnson [1980] and Altonji and Card [1991] provide formal theoretical frameworks). Theory also provides insight into the conditions under which the empirical researcher will or will not be able to detect that impact.

Taking the most restrictive case first, consider a closed economy model, with no international flows of good or capital, in which production takes place using capital and labor. If there is only one type of labor, then an influx of immigrants will reduce the capital-labor ratio and thus lower the wage. In a model with more than one type of labor, the effect of immigration on natives' labor market outcomes will depend on the degree of substitutability between immigrant and native workers. Immigrants will raise the wages of workers with whom they are complements in production or gross complements (i.e., substitutes in production for whom the scale effect exceeds the substitution effect). Immigrants will lower the wages of workers with whom they are gross substitutes. This negative effect will be magnified if immigrants are prepared to work for less than natives. If labor supply is perfectly inelastic, immigration will not affect native employment. However, if labor supply and labor demand are both elastic, native employment will move in the same direction as wages, and the change in wages will be smaller than in the former case.

In an open economy model, compensating international flows of factors of production or of goods embodying them (as in Heckscher and Ohlin) will offset any changes in wages or returns to capital caused by immigration, so that such effects will only exist in disequilibrium. In equilibrium, factor prices will be equalized across countries. In this case, immigration will not yield cross-country differences in wages, and it would be fruitless to look across countries to learn the effect of immigration on the labor market. The conditions for complete international factor price equalization (FPE) however, are quite stringent and unrealistic. The actual degree of FPE will depend upon the freedom with which goods and factors can flow to arbitrage price differentials.

Many studies exploit geographic variation in immigration within a country to search for evidence of immigration's impact. Analogously to the cross-country setting, whether an uneven distribution of immigrants across cities will result in cross-sectional differences in labor market conditions depends on the degree to which FPE holds within the country. There are fewer barriers to trade and factor flows across regions than across countries, so that FPE is more likely to hold within countries than between them. In the presence of full domestic FPE and the absence of international FPE, immigration will affect the aggregate wage of a country, but not the relative wages of cities in that country. Immigration's impact will not be observable along the geographic dimension because any incipient local effects will be diffused by the migration of native workers out of the high-immigration cities, by capital inflows into them, or by intercity trade.

In this paper I use a new approach to detecting the impact of immigration on native labor market outcomes. Because movement across occupations is not as free as movement across locations, FPE poses less of a problem in an analysis using cross-occupation variation than in one using cross-city variation. People are free to move from one city to another in search of better earnings opportunities. Occupational mobility is more restricted and often requires a large investment in retraining, greatly reducing the speed and extent to which workers respond to changes in the occupational wage structure. Equilibrium may only be restored by the changing occupational choices of new labor market entrants. Disequilibrium across occupations will therefore be more persistent than disequilibrium across local labor markets, and the impact of immigration more readily apparent.

IV. Estimation Framework

A. The Cross-Sectional Approach

To assess the impact of immigration on native wages and employment, the most basic approach is to regress the labor market outcome of interest on the presence of immigrants, i.e., the ratio or share of immigrants in the relevant labor market. In many existing studies, the unit of observation used is the city or region. This paper uses variation in immigration across two-digit occupations, with the regression analysis conducted on both occupation- and individual-level data.

The estimation issues that arise are easiest to illustrate using group-level data. Let N_j and R_j denote employment in occupation j of native and immigrant workers, respectively. Total employment in an occupation, E_j, is equal to $N_j + R_j$. Finally, define r_j as R_j/N_j, the ratio of immigrant to native workers in the occupation. Assuming a constant-elasticity labor demand function and approximating $\log(1 + r_j)$ with r_j, immigration will affect occupational wages through its proportionate effect on occupational employment (r_j). In the case of wages, the regression specification is

$$W_j = \alpha + X_j\beta + \gamma r_j + \epsilon_j, \tag{1}$$

where W_j is the average native log wage in occupation j and X_j is a vector of occupation-specific factors that could affect the level of wages (for example, the average age and education of the workers in the occupation, the industry mix of employment, etc.).

A potential problem with this approach is endogeneity. Immigrants may depress wages, meaning that $\gamma < 0$. However, if the distribution of immigrants across occupations is not independent of ϵ, the unobserved determinants of wages, then the conditional correlation of wages and immigrant density will confound the two directions of causality, and the estimate of γ will be biased. If immigrants choose occupations offering higher wages (i.e., occupations with high ϵ's), the estimate of γ will be biased upward, leading to an underestimate of immigration's negative impact on wages. On the other hand, if immigrants are confined to low paying occupations, the estimate of γ will be biased downward, leading to an overestimate of immigration's effect.

This endogeneity problem would seem to be quite serious when considering geographic variation in immigration, since local wages are likely to be an important factor influencing immigrants' locational choices. Endogenous choices are probably less of a problem along the occupational dimension, as immigrants cannot freely choose to enter any occupation, but are limited by their qualifications, skills, etc. At least in the short run, before they can undertake new training, immigrants' occupational choices may be relatively independent of occupational wages. However, endogeneity will still be a problem if employers' decisions to hire immigrants are not independent of wages.

B. The Multiple Cross-Section Approach

If immigrants choose or are hired into occupations on the basis of their wage levels, but not their wage growth, an endogeneity problem present in the first approach can be circumvented by using more than one cross section of data. In this approach, the change in wages over time is regressed on the inflow of immigrants over time:

$$(2)\quad (W_{j,t} - W_{j,t\text{-}k}) = (\alpha_t - \alpha_{t\text{-}k}) + (X_{j,t} - X_{j,t\text{-}k})\beta + \gamma(r_{j,t} - r_{j,t\text{-}k}) + (\epsilon_{j,t} - \epsilon_{j,t\text{-}k}).$$

Note that in the case in which the immigration occurs between time $t - k$ and time t, $r_{j,t\text{-}k}$ equals zero, so that the variable measuring immigration is the same as in the single cross-section specification. The estimated value of γ will measure the impact of immigrant inflows on wage growth, and will not reflect any simultaneous causality in the other direction. This approach has the benefit of differencing out any observable or unobservable fixed effects in wage levels. However, if immigrant flows are not independent of occupational wage growth, the problem of endogeneity will still be present in the differenced estimation.

C. The Instrumental Variables Approach

When both the single and multiple cross-section approaches suffer from endogeneity bias, it becomes necessary to use an Instrumental Variables approach. In order to identify the parameter of interest, γ, a source of independent variation in immigration must be found. In the multiple cross-section setting, the instrument must be correlated with the inflow of immigrants into an occupation but uncorrelated with the unobserved component of wage growth in that occupation subsequent to their arrival.

A source of exogenous variation in the entry of Russian immigrants into occupations in Israel may be found in the immigrants' previous occupational distribution abroad. Because workers have occupation-specific human capital, their earnings will tend to be highest in the occupation in which they have the most training and experience. For this reason, as well as because their previous occupational choices revealed something about their preferences, immigrants will tend to seek work in their former occupations. Thus, if the immigrant wave contained a large number of former engineers, we would expect the labor supply shock to engineering in Israel to be large, relative to the shock to other occupations. This source of variation is independent of the wages of engineers in Israel, relative to wages in other occupations. An immigrant's previous occupation in Russia was chosen on the basis of labor market conditions in Russia and his individual preferences. It preceded the immigrant's encounter with labor market conditions in Israel. The fact that the mass migration was a surprise to both the Russian immigrants and to the Israelis further strengthens the independence of the Russians' occupational choices and Israeli labor market conditions. This point will be discussed in more detail in the section on the data used to construct the instrument.

The labor market assimilation of immigrants takes time, and it is known that immigrants often experience occupational downgrading upon their initial arrival in the host country. Some immigrants remain in these lower occupations permanently. With time, and subject to imperfect human capital transferability, others move back into their former professions. Yet others enter a new occupation. The relative prevalence of these three patterns is not crucial here. For the purpose of identifying an instrument, the previous occupational distribution of the immigrants need only be correlated with their occupational distribution in Israel and uncorrelated with the unobserved determinants of changes in the Israeli wage structure subsequent to their arrival.

Let P_{jt} be the number of Russian immigrants in Israel at time t who worked in occupation j in Russia. P_{jt} will serve as the instrumental variable for R_{jt}, the number of Russian immigrants in Israel at time t who work in occupation j in Israel. Since in the specifications above, the independent variable, $r_{jt} = R_{jt}/N_{jt}$, is in the form of a ratio, P_{jt} must also be scaled by the size of the occupation. In order to allow for the possible endogeneity of N_{jt} as well as R_{jt}, the variable used to instrument for r_{jt} will be p_{jt}, defined as P_{jt}/N_{j0}, where N_{j0} is native employment before the immigration. Both p_{j0} and r_{j0} are equal to zero by definition.

D. Using Individual-Level Data

It is also possible to gauge the effect of immigration on the earnings of native workers by estimating an individual-level earnings function, including a measure of immigration as one of the independent variables:

$$w_{ijt} = X_{it}\beta_t + \alpha_t + \sum_{k=1}^{J} \delta_k occ_{jk} + \gamma r_{jt} + \epsilon_{ijt}, \tag{3}$$

where w_{ijt} is the log earnings of individual i in occupation j at time t, X_{it} is a vector of control variables, such as schooling, labor market experience, etc., α_t is a year dummy, occ_{jk} are a set of J occupation dummy variables, and r_{jt} is the ratio of immigrant to native workers in the individual's occupation. Using individual-level data has the advantage of added efficiency, relative to an analysis of mean occupational data.[6]

By pooling data from multiple time periods, this specification implicitly estimates the change in wages associated with a change in the presence of immigrants in an individual's occupation. The vector of coefficients on the occupation dummy variables (δ_k) captures interoccupation wage differentials which do not vary with time. The year dummy (α_t) captures average wage growth which does not vary with occupation. Therefore, γ, the coefficient on r, reflects the difference in wage growth experienced by natives in occupations with larger or smaller inflows of immigrants. Put in other words, α and δ capture the "main effects" of year and occupation, while γ captures their interaction in a particular form. In the present case, γ will reflect the degree to which native wage growth in an Israeli occupation between 1989 and 1994 varied with the extent of Russian immigration into that occupation over the same time period. This individual-level regression is thus comparable to a changes regression at the group level, rather than to a levels regression.

V. Data and Variables

A. The Instrument

The Israeli Immigrant Employment Survey (IES) interviews a random sample of 3300 new immigrants who arrived in

6. This one-step approach could be replaced by a two-step approach, similar to that used in Card and Krueger [1992]. Separate cross-section wage regressions would be run by year with a basic set of controls and a full set of occupation dummies in each year. The change in the coefficients on the occupation dummies (conditional occupational means) would then be regressed on measures of immigration.

Israel in 1990.[7] The data set includes information on conditions before migration (previous occupation, education, training, language skills, etc.) as well as current demographic and labor market information at several points in time. The information on the immigrants' former occupations in Russia is the variable that will serve as an identifying instrument in the analysis below.

The fact that these immigrants were among the earliest arrival cohorts of the mass migration strengthens the argument that the instrumental variable constructed on the basis of this group is independent of labor market conditions in Israel. To the extent that information about those conditions filtered back to the former Soviet Union, informing potential subsequent immigrants about relative earnings in Israel and causing selection in migration, this group of immigrants arrived early enough that this need not be a concern. Information about the Israeli labor market simply was not available in Russia at the time these immigrants left. In addition, the emigrants who left first were the ones most eager to flee, the group for whom concern about the unstable situation in Russia was sufficiently strong that the decision to emigrate was immediate. Even if detailed information about job opportunities in Israel had been readily available, it is very unlikely that it would have led to selective emigration among this group.

Figure III shows the distribution of new Russian immigrants across occupations in Israel in 1994 and across occupations in Russia preceding migration. Specifically, it graphs $\ln(R)$, the log of the number of Russians employed in the occupation in Israel in the 1994 Labor Force Survey (described below) against $\ln(P)$, the log of the number of Russians formerly employed in the occupation in Russia in the IES, scaled to have the same total. Logs are displayed rather than absolute numbers because of the very large relative size of the largest occupations. The relatively flat line on the graph plots the fitted values from an OLS regression of $\ln(R)$

7. The IES surveys a cohort of immigrants from the USSR who arrived in Israel or received immigrant status between October and December 1990, interviewing them annually in 1992–1994. The sampling frame was constructed from information from the Ministry of Absorption on the family units of arriving immigrants and the addresses of immigrants in the Population Register. The sampled unit was a cluster of immigrants who were members of a family unit and lived at the same address. For more details, see Israeli Central Bureau of Statistics [1994a].

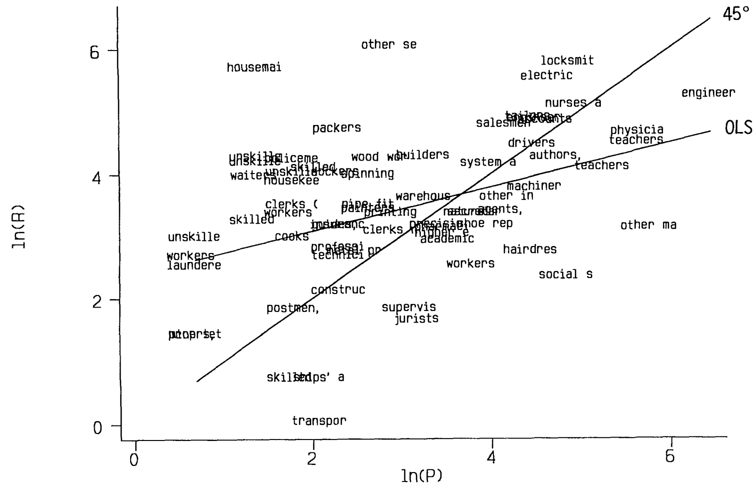

FIGURE III

Number of Russians in the Occupation in Israel and Abroad

Note: $\ln(R)$ is the log of the number of Russians in the occupation in Israel in 1994. $\ln(P)$ is the log of the number of Russians formerly in the occupation abroad.

on $\ln(P)$, which yields a coefficient of 0.354 (standard error .096) with an R^2 of 0.17. The correlation coefficient between R and P is 0.37.

If no Russians switched occupations following migration, all points would lie along the 45-degree line. The points most vertically distant from the line represent occupations to and from which the Russians disproportionately switched. The most important former occupations of Russians were engineer, manager, physician, and teacher. By contrast, the most important occupations of Russians in Israel are service worker, locksmith/welder, and housemaid. These occupations also had the most outflows and inflows, respectively. The occupations employing the greatest number of Russians relative to Israelis in 1994 (r) are unskilled workers.

B. Microdata on Israelis

The primary data sources used in the analysis below are the microdata of the Israeli Income Surveys (IS) and Labour Force

Surveys (LFS) of 1989 and 1994, the last year preceding the mass migration from Russia and five years later, respectively. The IS and LFS are household surveys similar to the U. S. Current Population Survey.[8]

Table I presents descriptive statistics for native Israelis and new Russian immigrants in the 1994 IS and LFS microdata. The sample used includes all employees aged 25–65 who are not self-employed. New Russian immigrants comprise 13 percent of this sample. On average, the Russians are half a year older and have one more year of schooling than the Israelis. However, while less than one-third of the Israelis have completed more than fourteen years of schooling, over half of the Russians have. The average new Russian immigrant had been in Israel 3.1 years at the time of the survey. Among "native" Israelis, 39.2 percent are foreign-born, having arrived in Israel 31.5 years earlier on average.

Turning to labor market variables, Russians are more likely than Israelis to work full-time. The average hourly wage of Israelis (calculated by dividing average monthly income from salaried work by weeks worked multiplied by average weekly hours) is 24.28 1994 New Israeli Shekels (NIS), which in 1994 U. S. dollars is approximately $8. Russians earn about 45 percent less, with average hourly earnings of 13.46 1994 NIS. This large differential is consistent with other studies of new immigrants' labor market outcomes, relative to those of natives (see footnote 4). The bottom panel of Table I shows the breakdown of Israelis and Russians by one-digit occupation and industry. Russians are more likely than native Israelis to be in skilled or unskilled blue-collar jobs and in services. They are less likely to be managers or clerks. With respect to industry, Russians are overrepresented in manufacturing and underrepresented in the public sector, relative to Israelis.

8. The IS is conducted on the fourth rotation group of the LFS. The sampling frame of the IS includes only urban residents, and the variable definitions are often coarser than in the LFS data. The LFS is therefore superior to the IS for data other than earnings information (which is only available in the IS) such as the distribution of new immigrants across occupations, the characteristics of workers by occupation and skill group, etc. The 1989 (1994) LFS contains 92,469 (102,688) observations, of which 13,529 (15,399) are IS observations. For more details, see Israeli Central Bureau of Statistics [1991, 1994b, 1996].

TABLE I
SUMMARY STATISTICS

	Israelis	Russians
Age	40.4	40.9
	(10.1)	(9.6)
Years of schooling	13.0	14.0
	(3.7)	(2.9)
More than 14 years of schooling (%)	32.2	53.2
Female (%)	44.7	45.9
Arab (%)	9.8	0.0
Asia-Africa origin (%)	43.9	0.0
Immigrant (%)	36.4	100.0
Years since migration	31.0	3.1
	(12.9)	(1.1)
Full-time (%)	60.5	67.1
Hourly wage (1994 NIS*)	23.21	14.53
	(19.36)	(11.73)
Occupational composition of employment:		
0 Scientific and academic professionals	10.7	11.2
1 Other free professionals, technicians, etc.	19.3	13.3
2 Managers	6.2	.3
3 Clerks	19.1	5.5
4 Sales workers, agents, etc.	6.7	3.4
5 Service workers	13.1	23.1
6 Farm workers	1.8	1.8
7 Skilled workers in ind., transp., const. I	11.0	21.3
8 Skilled workers in ind., transp., const. II	9.5	9.5
9 Unskilled workers in ind., transp., const.	2.7	10.6
Industrial composition of employment:		
0 Agriculture	1.6	1.8
1 Industry I (mining, manufacturing)	8.7	17.0
2 Industry II (mining, manufacturing)	12.1	19.6
3 Electricity and water	1.4	1.0
4 Construction	5.4	6.6
5 Commerce, restaurants, hotels	12.0	11.6
6 Transport, storage, and communication	5.6	3.0
7 Financing and business services	11.0	8.7
8 Public and community services	36.4	21.0
9 Personal and other services	5.9	9.8

"Russians" denotes post–1988 immigrants from the former Soviet Union. All others are counted as "Israelis," including both the native-born and other immigrants. The sample includes all employees aged 25–65, excluding the self-employed. Information on earnings is taken from the 1994 Israeli Income Survey (IS) and on other variables from the 1994 Labour Force Survey (LFS). There are 4715 Israelis and 890 Russians in the IS sample and 30,319 Israelis and 3954 Russians in the LFS sample. Standard deviations are in parentheses.

* The 1994 exchange rate was roughly 3 NIS (New Israeli Shekels) to the U. S. dollar.

TABLE II
THE EFFECT OF IMMIGRATION ON NATIVE ISRAELI WAGES:
OCCUPATION-LEVEL ANALYSIS

	Dependent variable		
Independent variable	r	Log wage of Israelis 1994	Change in log wage of Israelis 1989–1994
r		−1.54 (.386)	−.616 (.206)
p	.240 (.087)		.0718 (.149)
r instrumented with p			.549 (1.28)

Each coefficient comes from a separate regression. Variables are unconditional means by two-digit occupation. The wage measure is the log of average hourly earnings. r equals R/N_1, where R is the number of Russians employed in the occupation in Israel in 1994, and N_1 is the number of native Israelis employed in the occupation in Israel in 1994. p equals P/N_0, where P is the number of Russians employed in the occupation in Russia, and N_0 is the number of native Israelis employed in the occupation in Israel in 1989. Wage regressions are weighted by 1994 Israeli employment. The data source for the wage variables is the 1989 and 1994 IS and for the employment variables is the 1994 LFS and 1990 IES. Standard errors are in parentheses.

VI. RESULTS

A. Occupation-Level Analysis of Wages without Covariates

The basic relationships among the key variables can be illustrated using occupation-level data without conditioning on any covariates. Table II assesses the impact of immigration on native wages, using mean occupational wage and immigration measures which have not been corrected for any correlation with control variables such as education, experience, etc. Each column has a different dependent variable, and each row has a different independent variable, so each number in the table is a coefficient from a different regression.

The first column of Table II shows the first-stage equation, in which the potentially endogenous regressor r, is regressed on the proposed instrument p. This regression measures the strength of the relationship between the labor supply shock to an occupation that would be implied by the former occupational distribution of the immigrants and the actual ratio of Russians to native Israelis observed in the occupation, ex post. Note that if there were no change in native employment by occupation over the five-year period, and if Russians did not change occupations following migration, this coefficient would equal one. The estimated coefficient is 0.240 (*s.e.* .087), indicating a significant positive correlation between the two variables.

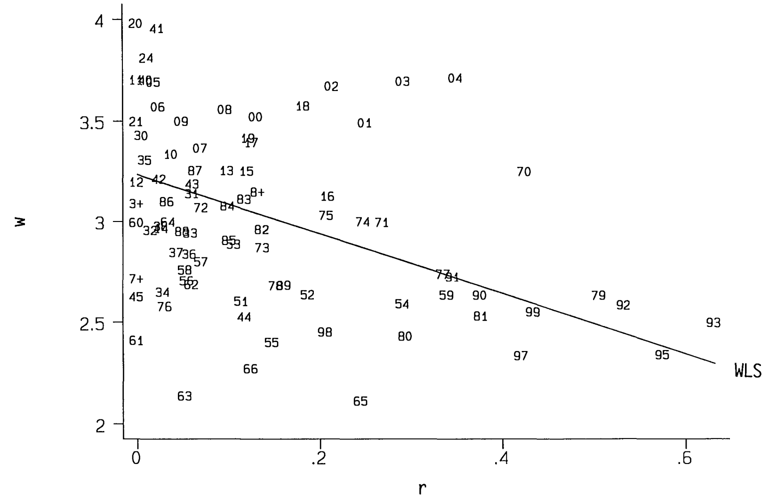

FIGURE IV
Israeli Wages and the Presence of Russians in the Occupation in Israel
Note: W is the average log wage of Israelis in 1994. r is the ratio of Russians to Israelis in the occupation in 1994.

The effect of immigrants on the level of native log wages in 1994 is evaluated in the second column of Table II. The least-squares regression coefficient of -1.54 (*s.e.* .386) indicates a very strong negative relationship between the presence of immigrants in an occupation and the wages of native Israelis in that occupation. The data and regression line are shown graphically in Figure IV. Observations are denoted by their two-digit occupation codes, a list of which is provided in Appendix 1. No observations stand out as outliers.

However, for the reasons discussed above, regressions based on a single cross section may be biased. An evaluation of the effect of changes in immigrant presence on changes in wages is presented in the final column of the table. Regressing the change in the log hourly earnings of native Israelis 1989–1994 on r yields a coefficient of $-.616$ (*s.e.* .206), indicating that a 10 percent increase in employment due to an influx of immigrants is associated with a 6.0 percent drop in native wages. This effect is large, compared with most found in the literature. Figure V graphs the data and regression line, again showing that the estimate is not driven by outliers.

It is noteworthy that the coefficient in the changes specifica-

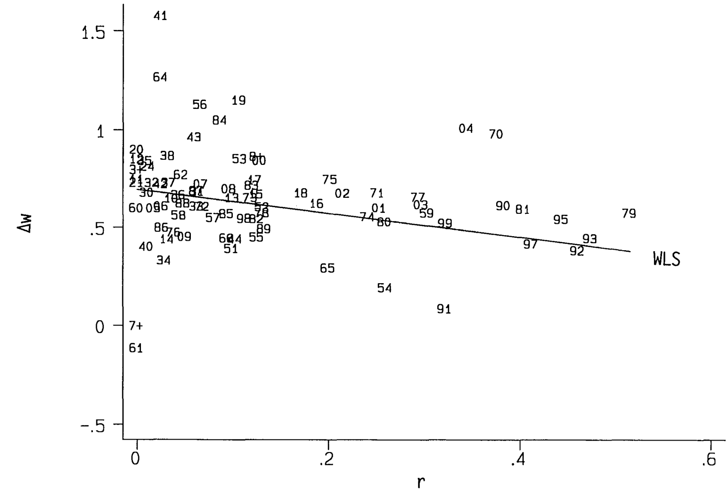

FIGURE V
Israeli Wage Growth and the Presence of Russians in the Occupation in Israel
Note: ΔW is the change in the average log wage of Israelis 1989–1994. r is the ratio of Russians to Israelis in the occupation in 1994.

tion is less than half the size of the coefficient in the levels specification. This indicates that a substantial component of the negative cross-sectional correlation between immigration and native wages in 1994 is due to a negative correlation between immigration and the level of native wages which existed in 1989, and positive serial correlation in wages by occupation. Put in other words, occupations with more Russians in 1994 were indeed low-wage occupations, but apparently they were low-wage occupations even before the Russians arrived. Regressions of 1994 immigrant employment on 1989 native wages do indeed yield statistically significant negative coefficients. The disproportionate entry of immigrants into low-paying jobs may be attributed to their inferior Hebrew-language skills and the imperfect transferability of their human capital only five years following immigration. It is also consistent with discrimination or ranking relative to natives in the labor market.

Although the multiple-cross-section approach improves on the single-cross-section approach, it may still suffer from endogeneity bias, and so we turn to IV estimation. The reduced-form equation, shown in the second row of the last column of Table II, yields an insignificant positive effect of p on the change in log

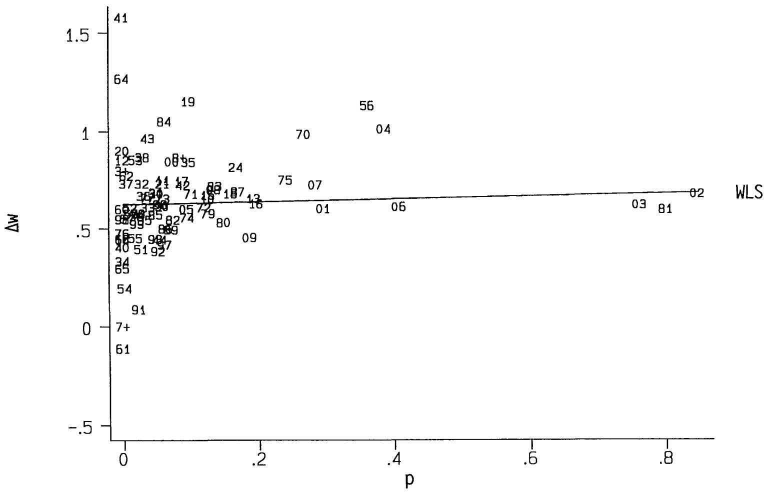

FIGURE VI

Israeli Wage Growth and the Presence of Russians in the Occupation Abroad

Note: ΔW is the change in the average log wage of Israelis 1989–1994. p is the ratio of Russians formerly in the occupation abroad to Israelis in the occupation in 1994.

wages (0.0718, *s.e.* .149). The 2SLS estimate in the final row, showing the effect of r on wage growth when r is instrumented with p, is also positive and not statistically significant. The point estimate of 0.549 (*s.e.* 1.28) implies that a 10 percent increase in employment due to an influx of immigrants is associated with a 5.6 percent rise in native wages. We cannot reject the hypothesis that immigration has no impact on native wage growth, and the point estimate is inconsistent with a negative effect.

To explore these findings, Figure VI plots the data and reduced-form regression line. The observations labeled 02, 81, and 03 denote engineers, shoe repair workers, and physicians, respectively. Twenty-four percent of the Russian immigrants were formerly engineers or physicians, and the number of former Russian shoe repair workers was large relative to that sector in Israel. These occupations are outliers in terms of the variable p—the number of Russians formerly in the occupation, relative to the number of Israelis in the occupation when they arrived—but their wage growth over this period was not atypical. Although these observations are important in determining the slope of the regression line, if they are excluded from the sample, the slope

TABLE III
THE EFFECT OF IMMIGRATION ON NATIVE ISRAELI WAGES: INDIVIDUAL-LEVEL ANALYSIS

Dependent variable	Estimation method	Independent variable p	Independent variable r	R^2	N
w	OLS		−.324 (.086)	.53	8353
r	OLS	.188 (.029)		.76	8353
w	OLS	.135 (.057)		.53	8353
w	2SLS		.718 (.343)		8353

Robust standard errors, which correct for clustering by occupation by year, appear in parentheses (see Moulton [1986] and Shore-Sheppard [1996]). w is the log hourly wage of native Israelis. See the note to Table II for definitions of r and p. The regressions control for years of schooling, years of potential labor market experience, sex, ethnicity, nativity, years since migration, and one-digit industry, with the returns allowed to vary by year. They also include a set of time-invariant two-digit occupation dummies. The estimated coefficients on the control variables are reported in Appendix 2. Individual-level data are from pooled IS 1989 and 1994. Occupation-level data are from LFS 1994. The sample excludes new immigrants, the self-employed, and those below age 25 or above age 65.

remains positive, becoming larger and less significant. Before discussing these results further, we first turn to an analysis of microdata.

B. Individual-Level Analysis of Wages with Covariates

Occupation-level regressions that do not control for other factors affecting wages may be misleading because of changes over time in the composition of workers within occupation or secular changes in the returns to factors such as education. Regressions on pooled individual-level data with controls for individual covariates and time-varying returns to them can correct for omitted variable bias in the unconditional occupation-level analysis caused by a correlation between immigration and other factors that affect wages.

Estimates of the effect of immigration on the wages of native Israelis using the pooled 1989 and 1994 Income Survey microdata are presented in Table III. The unit of observation is the individual native worker. The dependent variable is the log of hourly earnings. The explanatory variables include a piecewise linear function of years of schooling, a quartic in experience and dummy variables for full-time, sex, Arab ethnicity, Asian-African origin, immigrant status (and its interaction with years since migration), one-digit industry, and two-digit occupation. All of the control variables are also interacted with a year dummy (which also enters separately), except for the set of occupation dummies, which are time-invariant. The time-varying industry dummies capture changes in the capital stock or in demand conditions, e.g., a positive shock to the construction industry during this period of high immigration. The presence of new Russian immigrants in the individual's occupation, r, is equal to zero by definition for observations in 1989. For observations in 1994 the value of r is computed by two-digit occupation.

The OLS specification given by equation (3) is shown in the first row of the table. The coefficients on the control variables are reported in Appendix 2. The estimated coefficient on r is $-.324$ (*s.e.* .086). This implies that a 10 percent increase in employment due to an influx of Russians is associated with a 3.2 percent fall in the hourly earnings of Israelis in that occupation. This effect is weaker than the unconditional occupation-level effect obtained above and close to the estimated coefficient of $-.262$ found in the equivalent specification by Altonji and Card [1991]. The contrast between the unconditional occupation-level and conditional individual-level results suggests negative omitted variables bias in the former, implying that r is negatively correlated with the covariates X; e.g., that less educated natives are more likely to work with immigrants.

The second row of Table III presents the first-stage equation, regressing the presence of immigrants currently working in the individual native's occupation, r, on the presence of immigrants formerly working in that occupation, p, and the full set of control variables used for OLS. Note that although r and p are occupation-level variables, this is an individual-level regression, since X varies at the individual level. There is a significant positive relationship between r and p. The coefficient on p is 0.188 (*s.e.* .029), and the R^2 is 0.76. This point estimate is similar to the one obtained in the occupation-level data.

The reduced-form equation of log wages on p and X is given in the third row. As in the occupation-level analysis, the point estimate is positive, and in this case, it is statistically significant. The final row shows the effect of r on log wages, when r is instrumented with p and X, using 2SLS. The estimated coefficient, which had been significantly negative using OLS, is significantly positive in the instrumented estimation, with a coefficient of 0.718 (*s.e.* .343). The point estimate implies that a 10 percent increase in employment due to an influx of Russians leads to a 7.4 percent rise in the hourly earnings of Israelis in the occupation, which is a very large effect.

These results are qualitatively similar to those obtained with occupation-level data. As in that analysis, the contrast between the OLS and IV estimates indicates that the distribution of Russian immigrants across occupations in Israel was not independent of the unobserved determinants of wages in those occupations and that, as a result, OLS yields overestimates of immigration's negative impact on native wages. The conclusion of both the occupation- and individual-level analyses is that the influx of Russians to a given occupation in Israel does not appear to have adversely affected the wage growth of natives working in that occupation. In the latter case, the positive effect is significant.

C. Interpretation of OLS versus IV Results

To understand the difference between the OLS and IV results, recall that whenever a vector of explanatory variables, X, includes variables which are correlated with the disturbance term, ϵ, the expected value of the OLS estimate of β is equal to $\beta + (X'X)^{-1}(X'\epsilon)$. Therefore, when the IV estimate, which is consistent, is greater than the OLS estimate, which may be biased, it suggests that $(X'X)^{-1}(X'\epsilon) < 0$. In this case, it implies a negative correlation between the exogenous component of wage growth in an occupation and the entry of Russian immigrants into that occupation. This is the same pattern revealed by the contrast between the OLS levels and changes regressions. The difference between the OLS and IV results implies that the negative correlation between immigration and native wages found by OLS is due not to an adverse impact of immigration on native wages, but rather to the immigrants having disproportionately entered low-wage, low wage-growth occupations.

Note that the negative bias to OLS uncovered here is the opposite of the positive bias to OLS found in the literature on geographic wage differentials. A positive bias results when immigrants can choose to go to high-wage areas/occupations, while a negative bias results if they can only find work in low-wage areas/occupations. Immigrants apparently tend toward high-wage cities, but low-wage jobs. This is not surprising since as discussed above, geographic mobility within a country is unrestricted, while occupational mobility may be limited by the demand side.

The absence of a negative impact of immigration on native wages might be explained by highly elastic labor demand or an inflexible labor market. However, these estimates suggest that not only did the Russian immigration not depress the wages of native Israelis, it may in fact have raised them. This is inconsistent with models in which immigrants and natives are considered to be close substitutes and suggests the possibility of complementarity between Russian and Israeli workers within occupation.

In fact, there is a good deal of independent evidence supporting the idea of such complementarity. Sussman and Zakai [1998] study the labor market for physicians in Israel in the early 1990s. They find that Russian physicians—even those with considerable prior experience and expertise—were confined to positions as generalists at the lower end of the pay scale in Israeli hospitals. This enabled native Israeli physicians to be promoted to fill the higher-paying ranks in an expanding health-care system. In addition, because the Russians relieved the overall staffing burden at hospitals, native Israelis were able to devote more time to yet higher-paying private-practice work. Sussman and Zakai conclude that "relations between the two groups were complementary rather than competitive. . . in providing medical services."

In the case of engineers and other highly educated specialists, a government committee [Eckstein et al. 1996] gathered evidence on the nature of their employment. Firm managers testified that Russian workers were often assigned to more basic tasks or supportive roles, freeing Israelis to work on the more productive aspects of projects. As in the case of physicians, Russian workers filled positions at the lower end of the job ladder, pushing incumbent Israelis up the ranks into more supervisory, high-paying roles.

However, although these results are consistent with a story of complementarity, they do not rule out alternative explanations. For example, at the same time as the Russian immigration, there was a boom in Israel's high-tech sector, particularly in software. The boom could have more than offset a latent depressing effect of the immigration on wages by increasing demand for high-skilled technical workers at the same time as the Russian immigration increased their supply. Native wages might therefore have risen despite, not because of, the immigration.[9] Removing technical sectors from the sample, however, does not alter the results.

In general, a simultaneous expansion in demand would not seem to offer a satisfactory overall explanation of the results, since it seems unlikely that domestic demand expanded in proportion with labor supply across occupations. However, a plausible possibility is suggested by the fact that ϵ reflects not only domestic but also shared global demand factors, including skill-biased technological change. The possibility of a resulting coincidental correlation between ϵ and the measures of immigrant penetration, r and p, is addressed in subsection D.

D. Alternative Specifications of Wage Equations

To investigate in more detail the effects found above, alternative samples and specifications of the effect of immigration on native Israeli wage growth over the period 1989–1994 are shown in Table IV. The first column reports the OLS estimate Δw regressed on r), the second column reports the first-stage equation (r regressed on p), and the third column reports the 2SLS estimate (Δw regressed on r instrumented by p). Individual-level regressions also include the vector of control variables X on the right-hand side and in the set of instruments.

One interesting question is whether the wage impact varies for workers at different skill levels. The occupation-level sample can be split into two groups according to the average years of schooling completed by workers in that occupation. Define high-skill occupations as those with workers with more than fourteen years of schooling and low-skill occupations as those with workers with fourteen or fewer years. This division results in 19 high-skill and 64 low-skill occupations (comprising 22.6 percent and 77.4 percent of workers, respectively).

The top two rows of Table IV show the results for low-skill and high-skill occupations. For the high-skill occupations, both

9. The high-tech boom itself could reflect a type of complementarity if the immigration was a causal factor in the expansion of that sector, along the lines of Acemoglu [1996]. However, the evidence suggests that the boom was already well underway when the Russians arrived, having been sparked by large cutbacks in military expenditures in the 1980s which resulted in the layoff of thousands of engineers, as well as by international expansion of the industry. Still, the rise in the aggregate native return to education following the arrival of the highly educated Russians is consistent with the story of social increasing returns in human capital accumulation suggested by Acemoglu and warrants further exploration.

TABLE IV
THE EFFECT OF IMMIGRATION ON NATIVE ISRAELI WAGES:
ALTERNATIVE SAMPLES AND SPECIFICATIONS

	OLS	First stage	2SLS
By skill group:			
Low skill	−.799	.352	6.08
	(.241)	(.147)	(16.6)
High skill	.314	.309	.265
	(.300)	(.082)	(.383)
By age group:			
18–34	−.299	.141	.913
	(.129)	(.043)	(.826)
35–65	−.359	.200	.670
	(.098)	(.028)	(.370)
Numerical immigration variable:	−.000583	.267	.00130
	(.00022)	(.0823)	(.00263)
Relative dependent variable:	−.532	.241	.387
	(.287)	(.087)	(1.44)

The dependent variable is the change in the log wage of Israelis 1989–1994. "Low-skill" and "high-skill" occupations refer to those with average worker schooling in 1989 of less than or equal to fourteen years and greater than fourteen years, respectively. Age-group regressions use individual-level data, with the same set of control variables as in Table III. The "numerical immigration variable" specifications replace the ratios r and p with the numbers R and P. The "relative dependent variable" specifications use wage growth relative to U. S. occupational wage growth over the same period as the dependent variable. Skill-group, numerical-regressor, and relative dependent variable regressions use occupation-level data. Standard errors are in parentheses.

OLS and IV yield positive coefficients. Although the standard errors are large (probably due to the small sample size), we can reject equality with the full-sample OLS estimates ($t = 3.1$ and 2.3, respectively). The OLS and IV point estimates are very close, implying an absence of endogeneity. The Russians who entered high-skill occupations do not appear to have entered those with particularly high or low wage growth. The point estimates indicate that for every 10 percent increase in occupational employment due to immigration, native wages rose by about 3 percent.

For the low-skill occupations, the OLS coefficient is negative and significant, while the IV coefficient is positive and insignificant. Although the OLS and IV point estimates are far apart—consistent with endogenous entry of Russians into low wage-growth occupations—we are unable to reject equality because of the large IV standard error. Still, these results suggest that the positive IV point estimate found in the full sample is not due to the high-skilled alone. Apparently, less-skilled native workers benefit from complementarities with immigrants as well. Anecdotal evidence is supportive of this finding. Informal observation of retail workers, garage mechanics, office clerks, and others reveals that Russian immigrants often perform lower-level work, with native Israeli workers taking on more supervisory functions.

A second interesting way to split the data is along age lines. The sample used thus far has been restricted to ages 25–65. Younger workers, aged 18–24, have been excluded because the LFS codes all of them as being 22 years old. This is in order to mask the size of the army-age population. To learn whether immigration has different effects on workers of different ages, I include these young workers and run the regressions on a sample aged 18–34 and compare it with a sample aged 35–65. If immigrants compete more with new native labor market entrants, we would expect the impact on the young to be stronger than on the old. In fact, the results are quite similar. We cannot reject that both the OLS and IV coefficients are the same in the different age samples.[10]

The functional form which has been used throughout presumes that what matters for wages in an occupational labor market is proportionate changes in employment due to immigration (e.g., a constant-elasticity labor demand function). An alternative specification would be one in which absolute changes, rather than percentage changes, in employment matter (e.g., a constant-slope labor demand function). To investigate the sensitivity of the results to this assumption, the third set of regressions in Table IV replicates the occupation-level analysis, replacing the ratio of Russians to Israelis working in an occupation, r, with the number of Russians, R. Similarly, the ratio of Russians to Israelis formerly in the occupation, p, is replaced with the number of Russians formerly in the occupation, P. The results using numbers are qualitatively similar to the results using ratios. This is not surprising, as variation in r and p is primarily due to variation in their numerators, and N_0 is highly correlated with N_1 ($\rho = .98$). Both versions show significant negative impacts of immigration in OLS, a significant first-stage fit between the endogenous

10. One explanation for this could be that, rather than lowering the wages of young employed natives, immigrants displace them in employment. Occupations with a large immigrant presence did experience a fall in the fraction of native workers under age 30 in the period 1989–1994. However, the correlation is weak ($\rho = -.15$), and there is no correlation between the change in the age composition of an occupation and the change in its wages over the period.

regressor and the instrument and insignificant positive IV coefficients.

A final concern, raised in subsection C, is that the pattern of estimates found here could be coincidental. The high-education occupations that the Russian immigrants formerly held are occupations that had higher wage growth in Israel in 1989–1994. The low-education occupations that the Russians currently hold in Israel are occupations that had lower wage growth. Perhaps the pattern of wage growth was not due to immigration, but rather to the general rise in the return to education that has occurred in many industrialized countries.

One piece of evidence against this story is that the individual-level analysis in Table III allows for economywide changes in the return to schooling over time, with the same result as in the occupation-level analysis. A further test of this idea can be carried out by studying wage growth relative to wage growth in the United States, using U. S. wage growth to capture global changes in educational differentials. I use the U. S. Current Population Survey from March 1989 and March 1994 to measure real wage growth in the United States by two-digit Israeli occupation. I then calculate wage growth in Israel, relative to wage growth in the United States, by occupation. The results of regressions using this as the dependent variable are presented in the last row of Table IV. The results are similar to the original analysis. OLS yields a negative coefficient, while IV yields a positive one.

Table IV thus shows the finding of a significant negative OLS effect and an insignificant positive IV effect to be robust to several alternative specifications of the equation and sample.

E. Occupation-Level Analysis of Employment

Having found that immigration does not appear to have lowered the wages of natives, it is interesting to investigate whether there was an impact in the employment dimension. Evidence of native displacement would provide support for the argument that the lack of a negative wage effect was due to offsetting movements of native workers out of those occupations into which the immigrants flowed.

In Table V, native employment growth in an occupation, defined as $N_{j,t} - N_{j,t\text{-}k}$, is regressed on the entry of new immigrants into that occupation, $R_{j,t} - R_{j,t\text{-}k}$. In these data, $R_{j,t\text{-}k}$ equals zero, so the change in the number of natives employed in an occupation from 1989 to 1994 is simply regressed on the

TABLE V
THE EFFECT OF IMMIGRATION ON NATIVE ISRAELI EMPLOYMENT: OCCUPATION-LEVEL ANALYSIS

Independent variable	Dependent variable: R	Dependent variable: Change in employment of Israelis 1989–1994
R		−.165
		(.120)
P	.300	.169
	(.075)	(.098)
R instrumented with P		1.86
		(2.20)

Each coefficient comes from a separate regression. The dependent variable in the last column is the change in the number of natives employed in the two-digit occupation between 1989 and 1994. R is the number of Russians employed in the occupation in Israel in 1994. P is the number of Russians employed in the occupation in Russia. The data sources are the 1989 and 1994 LFS and the 1990 IES. Employment regressions are weighted by 1989 Israeli employment. Standard errors are in parentheses.

number of Russians employed in the occupation in 1994.[11] Each number in Table V is a coefficient from a different regression.

The least-squares regression coefficient in the top row is negative, but small and not statistically significant. The point estimate implies that, at most, for every six new Russian workers, one native worker left the occupation. Just as in the wage analysis, however, OLS may be biased. R may be positively correlated with the error term because both native and immigrant workers are drawn to occupations with good characteristics. This would lead to upward bias in the OLS coefficient and an underestimate of immigration's adverse employment impact. Alternatively, R may be negatively correlated with the error term, if Russians can only get work in occupations with undesirable characteristics.

To get around this bias, we again use 2SLS estimation, instrumenting for R with P. The first column of Table V shows the first-stage equation, regressing R on P, i.e., the number of Russians employed in each occupation in Israel on the number who were employed in each occupation in Russia. The estimated coefficient on P is 0.300 (*s.e.* .075). Regressing the change in

11. Specifying the employment regressions in terms of proportional changes $((N_{j,1994}\text{-}N_{j,1989})/N_{j,1989}$ regressed on $R_{j,1994}/N_{j,1994}$ or $P_j/N_{j,1994})$ rather than absolute changes ($N_{j,1994}\text{-}N_{j,1989}$ regressed on $R_{j,1994}$ or P_j) yields qualitatively similar results.

native employment, ΔN, on the number of Russians in the occupation abroad, P, (the reduced-form equation) or on R instrumented with P (2SLS) yields positive but statistically insignificant coefficients. Although the standard errors are large, the 2SLS point estimates have reversed the sign of OLS.

The conclusion of the employment analysis is therefore similar in spirit to those of the wage analysis. OLS shows a negative (if insignificant) relation between native employment growth and immigrant entry. Because of the potential endogeneity of immigrant entry into an occupation, it is unclear whether we can conclude that natives were displaced by immigrants. Instrumenting for the native inflow with the immigrants' occupational distribution abroad shows that the negative OLS relationship is not in fact due to displacement of natives by immigrants, but rather to the fact that immigrants went into contracting occupations. This is consistent with the evidence given above that immigrants went into low wage, low wage-growth occupations.[12]

VII. Conclusion

The recent mass migration to Israel from the former Soviet Union provides a natural experiment for the study of immigration's impact on the labor market outcomes of natives. Least-squares estimates using occupation- and individual-level data on the earnings of native Israelis before and after the migration indicate that natives in occupations which received more immigrants experienced lower earnings growth over the period 1989–1994. A 10 percent increase in occupational employment due to immigration is associated with a 3–6 percent decrease in the real hourly earnings of natives in that occupation. There is, at most, weak evidence of a negative impact on native employment levels.

However, because the distribution of immigrants across occupations may not have been independent of relative labor mar-

12. One reason for the unresponsiveness of native employment may be that workers have occupation-specific human capital. Friedberg [1998] investigates whether there were changes in the kinds of specific human capital in which Israelis chose to invest, by examining the distribution of undergraduate and graduate students in Israel across fields of study. I find that the share of students majoring in medicine and engineering fell substantially in the early 1990s, while the share majoring in law—a field with almost no Russians—rose. The change was particularly marked among freshmen and prospective freshmen. However, the magnitude of the response was insufficient to offset the entry of Russians into those fields. For example, for every ten Russian engineers who arrived, only one student in Israel switched out of engineering.

ket conditions across occupations, an Instrumental Variables approach is used to reestimate the relationship between immigration and native wages and employment. There is a significant positive correlation between the former presence of the immigrants in an occupation in the former Soviet Union and their presence in that occupation in Israel. But the previous occupational choices of the Russians abroad are independent of wage and employment growth in Israel subsequent to their arrival. The former occupational distribution of the immigrants can therefore be used as a source of exogenous variation in their occupational distribution in Israel.

When previous occupations are used to instrument for current occupations, Two-Stage Least Squares yields a different conclusion from OLS. At the occupation level, we cannot reject the hypothesis that the mass migration of Russians to Israel did not affect the earnings or employment of native Israelis, and the point estimates are inconsistent with a negative impact. At the individual level, controlling for worker characteristics, the positive effect on wage growth is statistically significant. This points to the possibility of complementarity between immigrant and native workers, although alternative explanations, such as coincident skill-biased technological change, would suggest that IV may be upward biased. The IV results imply that the negative relationships found using OLS are due to immigrants entering occupations with low wages, low wage growth, and contracting employment, rather than to an adverse impact of the immigrants on native labor market outcomes.

Further research on the Russian immigration to Israel could shed light on the dynamics of the high-skilled labor market more generally. One issue is how the human capital investment decisions of future high-skill workers respond to conditions in the labor market. A second issue is the extent to which investment in physical capital adjusts to reflect changes in human capital across sectors. Finally, this immigration could be used to study mechanisms by which an increase in human capital accumulation may raise the return to human capital, either through complementarities or externalities. These issues are germane to policy questions such as the current debate in the United States over expanding immigration of high-technology sector workers.

APPENDIX 1: TWO-DIGIT OCCUPATION CODES

00 professionals in life sciences
01 academic professionals in natural sciences
02 engineers and architects
03 physicians and dentists
04 pharmacists and veterinarians
05 jurists
06 social sciences workers
07 workers in humanities
08 higher education teachers
09 teachers in second. and postsecond. education
0+ academic professionals ns
10 teachers in intermed. and prim. schools, kinderg.
11 accountants and cost accountants
12 workers in religion
13 authors, artists, composers, journalists
14 social workers and probation officers
15 nurses and other paramedical professions
16 natural sciences technicians
17 engineering technicians
18 system analysts, programmers
19 technicians and other free professionals nec
1+ technicians ns
20 legislative and executive authorities
21 managers in public services
22 managers of units for natural sciences
23 managers of units for humanities, social sciences
24 other managers
25 **********
26 **********
27 **********
28 **********
29 **********
2+ managers ns
30 supervisors
31 accounts clerks
32 secretaries, typists, etc.
33 warehouse and filing clerks
34 teleph., telegraph, radio operators
35 transport supervisors
36 postmen, inspectors, conductors
37 clerks (general)
38 clerks nec
39 **********
3+ clerks ns
40 wholesalers (proprietors)
41 retailers (proprietors)
42 agents, commercial travelers
43 insurance, estate agents and appraisers
44 salesmen
45 peddlers etc.

APPENDIX 1
(CONTINUED)

46 ***********
47 ***********
48 ***********
49 ***********
4+ merchants and agents ns
50 proprietors in lodging and catering services
51 cooks
52 waiters, barmen
53 housekeepers and room cleaners
54 housemaids
55 launderers
56 hairdressers, beauticians
57 policemen, firemen, etc.
58 guides, stewards, dental assistants
59 other service workers nec
5+ service workers ns
60 farmers (proprietors)
61 farm supervisors
62 skilled farm workers
63 fishermen
64 farm machinery operators
65 packing and sorting workers
66 unskilled ag. workers
67 *********
68 *********
69 *********
6+ agricultural workers ns
70 metal processors
71 locksmiths, welders, tinsmiths
72 machinery assemblers and repairers
73 pipe fitters and plumbers
74 electricians (incl. electronic products)
75 precision instr., watchmakers, goldsmiths
76 diamond workers
77 skilled workers—food, beverages, tobacco
78 woodworkers, carpenters, etc.
79 spinning, weaving workers
7+ industrial foremen ns
80 tailors, dressmakers, etc.
81 shoe repairs and other leather products workers
82 printing workers
83 other industrial craftsmen
84 miners, quarrymen
85 builders
86 construction machine operators
87 ships' and railway workers
88 drivers
89 painters
8+ skilled workers ns

APPENDIX 1
(CONTINUED)

90 dockers, porters
91 unskilled workers in chemicals and minerals
92 unskilled workers in rubber and plastic mfg
93 unskilled workers in food, beverage, and tobacco
94 engine and pump operators
95 packers
96 workers in nonmetallic minerals
97 workers in industry nec
98 construction workers nec
99 unskilled workers ns
9+ unskilled workers ns

APPENDIX 2: COVARIATE COEFFICIENTS FOR TABLE III INDIVIDUAL-LEVEL OLS

	Control variables		Interaction of control variables with dummy for 1994	
	Coefficient	*S.E.*	Coefficient	*S.E.*
Constant	1.357	(.2217)	.2994	(.2442)
Years of educ 1–8	.0333	(.0186)	−.0077	(.0214)
Years of educ 9–11	.0419	(.0088)	.0036	(.0144)
Years of educ 12	.0264	(.0258)	.0550	(.0387)
Years of educ 13–14	.0765	(.0150)	.0101	(.0188)
Years of educ 15+	.0406	(.0056)	−.0114	(.0102)
Experience	.0343	(.0174)	.0420	(.0213)
$Exp^2/100$	−.0914	(.1460)	−.0260	(.0178)
$Exp^3/1000$	.0092	(.0471)	.0062	(.0057)
$Exp^4/10000$	−.0003	(.0050)	−.0005	(.0006)
Full-time	−.1279	(.0340)	.0862	(.0397)
Female	−.2115	(.0236)	.0216	(.0285)
Arab	−.0705	(.0312)	.0339	(.0511)
Asia-Africa	−.0802	(.0175)	.0476	(.0250)
Immigrant	−.1780	(.0263)	−.0187	(.0421)
Years since migration	.0051	(.0009)	.0010	(.0013)
Agriculture	.1186	(.0808)	−.0193	(.1001)
Mining and mfg.I	−.0134	(.0717)	.0674	(.0745)
Mining and mfg.II	.1163	(.0737)	.0707	(.0770)
Elec. and water	.4077	(.0960)	.0458	(.1180)
Construction	.0446	(.0886)	.0868	(.0865)
Commerce	−.0145	(.0763)	.0587	(.0811)
Transp. and comm.	.1555	(.0702)	.1022	(.0964)
Financial and bus.	.1135	(.0794)	.0612	(.0892)
Public services	.0138	(.0695)	.1232	(.0724)

The reported coefficients are for the OLS specification given by equation (3) and shown in row 1 of Table III. Robust standard errors, which correct for clustering by occupation by year, appear in parentheses. The dependent variable is the log hourly wage of native Israelis. The regression also includes a set of two-digit occupation dummies. Individual-level data are from the pooled IS 1989 and 1994. Occupation-level data are from LFS 1994. The sample excludes new immigrants, the self-employed, and those below age 25 or above age 65.

BROWN UNIVERSITY AND NATIONAL BUREAU OF ECONOMIC RESEARCH

References

Acemoglu, Daron, "A Microfoundation for Social Increasing Returns in Human Capital Accumulation," *Quarterly Journal of Economics,* CXI (August 1996), 779–804.

Altonji, Joseph, and David Card, "The Effects of Immigration on the Labor Market Outcomes of Less-Skilled Natives," in J. Abowd and R. Freeman, eds., *Immigration, Trade and the Labor Market* (Chicago, IL: University of Chicago Press, 1991), pp. 201–234.

Bank of Israel, *Annual Report* (1997).

——, *Data Archive* (1999).

Beenstock, Michael, and Yitzhak Ben Menahem, "The Labour Market Absorption of CIS Immigrants to Israel: 1989–1994," Falk Institute Discussion Paper 95.05, December 1995.

Beenstock, Michael, and Jeffrey Fisher, "The Macroeconomic Effects of Immigration: Israel in the 1990s," *Weltwirtschaftsliches-Archiv,* CXXXIII (1997), 330–358.

Borjas, George, "The Economics of Immigration," *Journal of Economic Literature,* XXXII (December 1994), 1667–1717.

Borjas, George, Richard Freeman, and Lawrence Katz, "On the Labor Market Effects of Immigration and Trade," in G. Borjas and R. Freeman, eds., *Immigration and the Work Force: Economic Consequences for the United States and Source Areas* (Chicago, IL: University of Chicago Press, 1992) pp. 213–244.

Borjas, George, Richard Freeman, and Lawrence Katz, "Searching for the Effect of Immigration on the Labor Market," *American Economic Review,* LXXXVI (May 1996), 246–251.

Borjas, George, Richard Freeman, and Lawrence Katz, "How Much Do Immigration and Trade Affect Labor Market Outcomes?" *Brookings Papers on Economic Activity,* 1 (1997), 1–67.

Brezis, Elise, and Paul Krugman, "Immigration, Investment, and Real Wages," *Journal of Population Economics,* IX (February 1996), 83–93.

Card, David, "The Impact of the Mariel Boatlift on the Miami Labor Market," *Industrial and Labor Relations Review,* XLIII (January 1990), 245–257.

Card, David, and Alan B. Krueger, "Does School Quality Matter? Returns to Education and the Characteristics of Public Schools in the United States," *Journal of Political Economy,* C (February 1992), 1–40.

Carrington, William, and Pedro deLima, "The Impact of 1970s Repatriates from Africa on the Portuguese Labor Market," *Industrial and Labor Relations Review,* XLIX (January 1996), 330–347.

Eckstein, Zvi, Shmuel Adler, Kalman Gair, Yoram Weiss, Zvi Sussman, Jack Habib, Shalom Tain, Dalia Gordon, Eli Leshem, Gur Ofer, Benny Fefferman, and Menachem Gotlibovski, "Report of the Committee on 'Evaluation of Programs for the Advancement of Employment of Immigrant Engineers and Other Experts and the Utilization of the Human Capital of the Current Wave of Immigration," Report to the Israeli Ministry of Immigrant Absorption, 1996.

Eckstein, Zvi, and Ron Shachar, "On the Transition to Work of New Immigrants 1990–92," Falk Institute Discussion Paper 95.04, August 1995.

Flug, Karnit, Zvi Hercowitz, and Anat Levi, "A Small-Open Economy Analysis of Migration," Foerder Institute Working Paper 13–94, June 1994.

Flug, Karnit, and Nitsa (Kaliner) Kasir, "The Absorption in the Market of Immigrants from the CIS—the Short Run," Bank of Israel Discussion Paper 93.09, October 1993.

Flug, Karnit, Nitsa (Kaliner) Kasir, and Gur Ofer, "The Absorption of Soviet Immigrants into the Labor Market from 1990 Onwards: Aspects of Occupational Substitution and Retention," Bank of Israel Discussion Paper 92.13, November 1992.

Friedberg, Rachel, "Does University Students' Choice of Field of Study Respond to High-Skilled Immigration?" Brown University Economics Department Working Paper 99-7, 1998.

Friedberg, Rachel, and Jennifer Hunt, "The Impact of Immigrants on Host Coun-

try Wages, Employment and Growth," *Journal of Economic Perspectives,* IX (Spring 1995), 23–44.
Goldin, Claudia, "The Political Economy of Immigration Restriction in the United States, 1890–1921," in C. Goldin and G. Libecap, eds., *The Regulated Economy: A Historical Approach to Political Economy* (Chicago, IL: University of Chicago Press, 1994), pp. 223–257.
Hercowitz, Zvi, Nirit Kantor, and Leora Rubin Meridor, "Immigration and Growth under Imperfect Capital Mobility: The Case of Israel," Sackler Institute Working Paper 12-93, June 1993.
Hercowitz, Zvi, and Leora Rubin Meridor, "Macroeconomic Implications of Mass Immigration to Israel," Foerder Institute Working Paper 29-91, 1991.
Hercowitz, Zvi, and Leora Rubin Meridor, "Macroeconomic Ramifications of the Mass Immigration into Israel: An Update and Reexamination," *Economic Quarterly,* Anno 40 (October 1993), 377–390.
Hercowitz, Zvi, and Eran Yashiv, "A Macroeconomic Experiment in Mass Immigration," Tel Aviv University Working Paper No. 15–99, March 1999.
Hunt, Jennifer, "The Impact of the 1962 Repatriates from Algeria on the French Labor Market," *Industrial and Labor Relations Review,* XLV (April 1992), 556–572.
Israeli Central Bureau of Statistics, "Labour Force Surveys 1989," Special Series No. 894, 1991.
——, "Employment of Immigrants from U.S.S.R. Who Arrived in Israel in October–December 1990," Supplement to the Monthly Bulletin of Statistics, No. 4, 1994a.
——, "Income of Employees (Individuals) 1989, 1990, 1991," Special Series No. 963, 1994b.
——, "Labour Force Surveys 1994," Publication No. 1024, 1996.
——, *Statistical Abstract of Israel,* 1997.
Jaeger, David, "Skill Differences and the Effect of Immigrants on the Wages of Natives," U. S. Bureau of Labor Statistics, 1996.
Johnson, George, "The Labor Market Effects of Immigration," *Industrial and Labor Relations Review,* XXXIII (April 1980), 331–341.
LaLonde, Robert, and Robert Topel, "Labor Market Adjustments to Increased Immigration," *Immigration, Trade and the Labor Market,* J. Abowd and R. Freeman, eds. (Chicago, IL: University of Chicago Press, 1991), pp. 167–199.
LaLonde, Robert, and Robert Topel, "Economic Impact of International Migration and the Economic Performance of Migrants," *Handbook of Population and Family Economics,* M. R. Rosenzweig and O. Stark, eds. (Amsterdam: Elsevier Science B. V., 1997), pp. 799–850.
Moulton, Brent R., "Random Group Effects and the Precision of Regression Estimates," *Journal of Econometrics,* XXXII (August 1986), 385–397.
Pischke, Jörn-Steffen, and Johannes Velling, "Employment Effects of Immigration to Germany: An Analysis Based on Local Labor Markets," *Review of Economics and Statistics,* LXXIX (November 1997), 594–604.
Shore-Sheppard, Lara, "The Precision of Instrumental Variable Estimates with Grouped Data," Princeton Industrial Relations Section, Working Paper No. 374, December 1996.
Sussman, Zvi, and Dan Zakai, "The Mass Immigration of Physicians and the Steep Rise in Wages of Veterans in Israel: A Paradox?" Tel Aviv University and Bank of Israel, September 1998.
Weiss, Yoram, Robert M. Sauer, and Menachem Gotlibovski, "Immigration, Search and Loss of Skill," Tel Aviv University, Hebrew University, and Academic College of Tel-Aviv-Yaffo, 1999.
Weiss, Yoram, and Nissim Ben David, "The Effect of Business Cycles and Immigration on Labour Market Flows in Israel," Golda Meir Institute Working Paper 75, October 1994.