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No. 2983

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*INTERNATIONAL MACROECONOMICS*



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Discussion Paper No. 2983  
September 2001

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September 2001

## ABSTRACT

### A Macroeconomic Experiment in Mass Immigration\*

This Paper studies the effects of mass immigration from the former USSR to Israel in the 1990s on the employment of the native-born. The exogeneity and the size of this inflow make it a 'natural experiment' of macroeconomic proportions. An open economy macroeconomic model is used to analyse this experience, focusing on the differential entry of immigrants into the labour and goods markets and the ensuing dynamic implications for labour demand. The reduced form of the model – consisting of two equations for native employment and the relative price of domestic goods – is estimated, finding negative effects of immigration on native employment a year after arrival. The delay in the effect is attributed to a positive impact of immigration on the excess demand for goods and, thus, on the demand for labour earlier on.

JEL Classification: E24 and J61

Keywords: employment, immigration and open economy macroeconomics

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\*We thank Nathan Sosner and Guy Navon for able research assistance and the Sapir Center at Tel Aviv University for financial support. Any errors are our own.

Submitted 04 September 2001

# 1 Introduction

During the 1990s, a wave of mass immigration arrived in Israel from the former USSR: more than 800,000 immigrants entered the country within 10 years (1990-1999), representing an 18% increase in the population. An important aspect of this immigration experience is that it may be considered exogenous. It was generated by the opening of the emigration gates, as well as by the worsening political and economic conditions in the former USSR. Furthermore, due to changes in US immigration laws and the existence of tough European laws, Israel seemed to be the main option for Jewish emigrants. With its large variation during the decade, this wave of immigration offers a unique opportunity—a “natural experiment”—to examine the dynamic effects of immigration on the employment of the native-born. This paper studies these effects in a macroeconomic setup, which incorporates indirect effects via the goods market. The reduced form of the model is estimated.

While negative effects of immigration on the employment of the native-born may be expected, the evidence in the literature indicates surprisingly small effects. Borjas (1994, see in particular pp. 1695-1700)<sup>1</sup>, who reviewed and discussed this literature, points to two major conclusions: (i) immigration has a weak effect on the employment of the native-born even when the immigrant flows are large; (ii) this finding may be explained by outflows of native-born workers from localities or industries affected by immigration to other areas of the economy. One example is Card’s (1990) study of the Cuban Mariel boatlift to Miami in 1980. Though Miami’s labor force had grown by 7% almost overnight, the effects on the wages and employment of locals were very small. Zimmermann (1995, in particular pp. 53-54) points to similar conclusions for Europe.

This issue is re-examined here in a macroeconomic setup, focusing on the dynamic effects. The analysis is based on an open-economy framework of the type developed by Bruno and Sachs (1985) and Altonji and Card (1991). It allows for immigration effects on

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<sup>1</sup>For related discussions, see Borjas, Freeman and Katz (1997), Friedberg and Hunt (1995) and Zimmermann (1995).

both labor supply and labor demand. The latter works through the goods market and the relative price of the domestic good.

A key feature of the model is the differential entry of immigrants into the labor and goods markets. The differential entry triggers the following macroeconomic mechanism. Immigrants' participation in the labor market is related to the supply of domestic goods, while their participation in the goods market is related to the demand for these goods. Hence, differential entry generates changes in the relative price of domestic goods, which, in turn, affects labor demand and the employment of the native-born. In particular, the presumption here is that during the early stages after immigration, participation in the goods market is likely to be relatively stronger. This increases the relative price of domestic goods, having a positive effect on labor demand and native-born employment. Later on, relative participation in the labor market (or, indirectly, in the supply of goods) is likely to dominate, causing an opposite effect: a decline in the relative price of goods, lower labor demand and lower native-born employment. Over time, as participation of immigrants in the two markets becomes similar, the macroeconomic effects on native-born workers should vanish.

To the extent that differential participation is important only during a transition period, the mechanism described above should be temporary. Hence, the present analysis focuses on the effects of temporary excess demand for goods triggered by immigration—and the ensuing change in the relative price—on employment of the native-born.

Beyond the mechanism of differential participation and relative price adjustment, the conventional mechanism of direct labor substitution of immigrants for native-born workers is also considered. These two effects are characterized in the model by looking at two cases. One is imperfect mobility of capital and other imported inputs, where the labor substitution mechanism operates alongside the differential participation effect. The other is perfect mobility of capital and imported inputs, where labor demand adjusts immediately as immigrants enter the labor market, and hence the substitution effect is neutralized. In this case, without differential participation in the labor and goods markets, the real wage

and employment of native-born remain unchanged. Both cases are nested in a single setup, depending on the value of a key parameter.

The paper proceeds as follows: Section 2 discusses the Israeli immigration experience and reports relevant findings from previous studies. Section 3 presents the model. The data and the econometric approach are discussed in Section 4. Section 5 presents the results and Section 6 concludes.

## 2 The Israeli Immigration Experience in the 1990s

The immigration influx from the former USSR started at the end of 1989. Figure 1 shows the quarterly flows of working-age immigrants as percentages of the corresponding native-born population during the 1990s. The immigration flows were particularly high in 1990-1991, with a short decline in early 1991 due to the Gulf War. At the peak, 50,000 working-age immigrants arrived in one quarter—about 1.8% of the working-age native population. In the second part of 1991, the flow began to decline dramatically to around 10,000 per quarter, or 0.3% of the working-age population. Given this variation, the 1990s can be considered a “natural experiment” in immigration of macroeconomic proportions.<sup>2</sup>

Figure 1

A central issue in the present analysis are the effects of immigration on the goods market and on the relative price of imported goods (the “real exchange rate”), or the inverse of the relative price of domestic goods. Figure 2 plots the relative price of imports—the index of import prices divided by the deflator of business sector GDP. The relative price has a declining trend, which seems to reflect the Balassa-Samuelson effect. However, it can be

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<sup>2</sup>Using terminology of experiments, the quarters from the beginning of 1990 through the end of 1991 can be considered the “treatment group” and the rest of the sample the “control group.”

observed that the large immigration flows of 1990/1 are followed by a fast drop and then by a period of much more moderate decline.

## Figure 2

Three recent studies addressing this immigration episode present microeconomic evidence that is important for the present macroeconomic analysis. Friedberg (1997) studied the migrants' effects cross-sectionally. Using microdata from the Income Survey and the Labor Force Survey of the Israeli Central Bureau of Statistics, she finds—consistent with the cited literature—no significant effects on wages or employment of the native-born across occupations.<sup>3</sup> Note that these findings refer to the stock of immigrants. Eckstein and Shachar (1996) studied the mean duration between arrival and the first full-time job. Using a 1992 survey of 1106 immigrants, they report estimates of duration ranging between 12 and 25 months. This implies gradual entry of immigrants into the labor market. It should be noted in this context that each immigrant was entitled to a government-provided “absorption basket” that included monthly cash transfers and a rent allowance. Hence, even credit-constrained immigrants may have delayed entry into the labor market, if they so desired, in order to learn the language, become acquainted with labor market procedures, etcetera. Eckstein and Weiss (1998) found that, upon arrival, immigrants got no return for their imported skills, but that the prices of these skills rose gradually with the length of stay.

Summarizing, the “absorption basket,” immediate housing and consumption needs, and the evidence on gradual entry into the labor market stress the importance of differential entry into the goods and labor markets, and, in particular, stronger participation in the goods market at the earlier stages following immigration.

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<sup>3</sup>With OLS estimation, significant effects are found. However, when the pre-immigration occupational distribution is used to instrument the post-immigration distribution, the coefficients turn insignificant. Friedberg explains the OLS results by a bias induced by immigrants entering low wage-growth occupations.

### 3 The Model

The following model is a version of the open-economy framework used by Bruno and Sachs (1985, Chapter 5) and, in an urban immigration context, by Altonji and Card (1991). Assuming openness of the economy to trade seems natural for an economy which is open to immigration. A key variable in this context is the relative price of the domestic good in terms of the imported good.<sup>4</sup> The model has the following key features:

- (i) It incorporates differential entry of immigrants into the labor and goods markets.
- (ii) It focuses on the short-run dynamic effects of the immigration flows, while allowing for the possibility that the stock of immigrants does not affect native employment, as found in the literature.

Consider an open economy that specializes in the production of the domestic good  $Y$ , facing a downward sloping demand function for its output. Production requires the variable inputs of labor,  $L$ , and imported good  $M$ — which includes capital services and intermediate inputs. The economy faces a perfectly elastic supply of  $M$  from abroad at the foreign price  $P_m^*$ , and costless adjustment to the desired level of  $M$ . Two cases are considered: (i) constant returns to scale on  $L$  and  $M$ , and (ii) diminishing returns on  $L$  and  $M$ , given the existence of an unadjustable additional input  $M_0$ . The first case represents perfect capital mobility, and the second captures, in a simple way, imperfect capital mobility.<sup>5</sup> For simplicity, we abstract from technological progress. The aggregate production function of the domestic good is:

$$Y = L^\alpha M^\beta M_0^{1-\alpha-\beta}, \quad 0 < \alpha < 1, \quad 0 < \beta < 1, \quad \alpha + \beta \leq 1. \quad (1)$$

The case of perfect capital mobility corresponds to  $\alpha + \beta = 1$ .

Labor is supplied by two types of workers: native-born ( $N$ ) and immigrants ( $I$ ). The

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<sup>4</sup>In an economy that is closed to trade, immigration would trigger changes in the intertemporal relative price of goods, or the real interest rate, which shift the supply of native-born labor. In the current setup, it is the demand for labor that is affected by the excess demand for goods.

<sup>5</sup>These two cases allow for closed-form solutions of the model, which can be estimated.

(working-age) population of each type is exogenous and is denoted by  $P_N$  and  $P_I$  respectively. The native-born population grows at a constant rate, while the immigrant population is subject to shocks and evolves as  $P_{I,t} = \prod_{q=1}^{\infty} (\Delta P_I)_{t-q}$ , where  $(\Delta P_I)_{t-q}$  is the immigration flow with a lag of  $q$  periods. It is assumed that  $M_0/P_N$  is constant—i.e.,  $M_0$  grows at the same rate as that of the native-born population. What is important in the present context is that  $M_0$  does not react to the immigration flows.

The demands for labor and for imported inputs are implied by the conditions:

$$\alpha L^{\alpha-1} M^{\beta} M_0^{1-\alpha-\beta} = w, \quad (2)$$

$$\beta L^{\alpha} M^{\beta-1} M_0^{1-\alpha-\beta} = p_m, \quad (3)$$

where  $w$  is the wage in terms of the domestic good and  $p_m$  is the price of imported inputs in terms of the domestic good, or the “real exchange rate.” The macroeconomic mechanism, to be described below, works via  $p_m$ .

The labor supply functions of the native-born and of immigrants are specified as:

$$L_N = w^{\lambda} P_N, \quad \lambda > 0, \quad (4)$$

and

$$L_I = w^{\lambda} \overline{\Delta P_I} \overline{\theta}_I, \quad (5)$$

where  $\overline{\Delta P_I} \equiv \{(\Delta P_I)_{-1}, (\Delta P_I)_{-2}, \dots\}$  is the vector of immigration flows—which are not lumped into stocks in order to focus on gradual and differential entry into the labor and goods markets—and  $\overline{\theta}_I \equiv \{(\theta_I)_{-1}, (\theta_I)_{-2}, \dots\}$  is a transposed vector of equal length, defined as immigrant “labor-participation factors,” considered exogenous. According to (4), the corresponding factor for native-born is 1. For example,  $(\theta_I)_{-q}$  is the labor-participation factor for immigrants with a length of stay of  $q$  periods in the country. Given the process of learning the domestic language, labor market procedures and so forth,  $(\theta_I)_{-q}$  is expected to increase

with  $q$ , and to approach 1 from below.<sup>6</sup> Note that  $w^\lambda$  represents the participation rate for native-born (we abstract from factors other than the wage) and  $w^\lambda(\theta_l)_{-q}$  is the participation rate for immigrants with a length-of-stay of  $q$  periods.

From (4) and (5), total labor supply is given by:

$$L = w^\lambda(P_N + \overline{\Delta P_I \theta_l}), \quad (6)$$

or:

$$w = \frac{L}{P_N + \overline{\Delta P_I \theta_l}}^{\frac{1}{\lambda}}. \quad (7)$$

Using (2) and (7), labor market equilibrium requires:

$$\alpha L^{\alpha-1} M^\beta M_0^{1-\alpha-\beta} = \frac{L}{P_N + \overline{\Delta P_I \theta_l}}^{\frac{1}{\lambda}}. \quad (8)$$

Equations (3) and (8) are two equations for  $L$  and  $M$ , given  $p_m$ , and  $P_N + \overline{\Delta P_I \theta_l}$ . The solution is:

$$L = Z_1 M_0^{\frac{\lambda(1-\alpha-\beta)}{\lambda(1-\alpha-\beta)+1-\beta}} (P_N + \overline{\Delta P_I \theta_l})^{\frac{1-\beta}{\lambda(1-\alpha-\beta)+1-\beta}} p_m^{\frac{-\lambda\beta}{\lambda(1-\alpha-\beta)+1-\beta}}, \quad (9)$$

and

$$M = Z_2 M_0^{\frac{(1-\alpha-\beta)(1+\lambda)}{\lambda(1-\alpha-\beta)+1-\beta}} (P_N + \overline{\Delta P_I \theta_l})^{\frac{\alpha}{\lambda(1-\alpha-\beta)+1-\beta}} p_m^{\frac{-\lambda(1-\alpha-\beta)+1-\beta+\lambda\alpha\beta}{(1-\beta)[\lambda(1-\alpha-\beta)+1-\beta]}}, \quad (10)$$

where  $Z_1$  and  $Z_2$ —and the terms  $Z_3, Z_4, \dots$ , below—are constants. Because of complementarity in production, the vector of immigration flows  $\overline{\Delta P_I}$  affects positively, and the relative price of imports affects negatively, both total employment and imports of the intermediate good.

Substituting (9) into (7), and the resulting expression into (4), yields:

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<sup>6</sup>This seems consistent with the finding in Eckstein and Weiss (1998) of a rise in the prices of imported skills with the length of stay.

$$\frac{L_N}{P_N} = Z_1 M_0^{\frac{\lambda(1-\alpha-\beta)}{\lambda(1-\alpha-\beta)+1-\beta}} (P_N + \overline{\Delta P_I \bar{\theta}_l})^{\frac{-\lambda(1-\alpha-\beta)}{\lambda(1-\alpha-\beta)+1-\beta}} p_m^{\frac{-\lambda\beta}{\lambda(1-\alpha-\beta)+1-\beta}}. \quad (11)$$

Immigration has the standard negative effect on the employment rate of the native-born only if capital mobility is imperfect; otherwise, the exponent of  $P_N + \overline{\Delta P_I \bar{\theta}_l}$  is zero. A decline in  $p_m$  (a higher relative price of the domestic good) increases labor demand and, thus, the employment rate.

To close the system, it is necessary to spell out the equilibrium condition in the domestic good market and to solve for  $p_m$ . The supply function is derived by substituting the expressions for  $L$  from (9) and for  $M$  in (10) into the production function (1):

$$Y^s = Z_3 M_0^{\frac{(1-\alpha-\beta)(1+\lambda)}{\lambda(1-\alpha-\beta)+1-\beta}} (P_N + \overline{\Delta P_I \bar{\theta}_l})^{\frac{\alpha}{\lambda(1-\alpha-\beta)+1-\beta}} p_m^{\frac{-\beta(1+\lambda)}{\lambda(1-\alpha-\beta)+1-\beta}} \quad (12)$$

Supply increases in native population and in immigration—depending on its labor market participation—and decreases in the relative price of imports. Demand is specified as:

$$Y^d = p_m^\varepsilon (P_N + \overline{\Delta P_I \bar{\theta}_y}), \quad \varepsilon > 0, \quad (13)$$

where  $\varepsilon$  is the relative price elasticity of demand and  $\bar{\theta}_y \equiv \{(\theta_y)_{-1}, (\theta_y)_{-2}, \dots\}$  is a vector of immigrant “participation factors” in the goods market, which are exogenous and parallel to the  $\bar{\theta}_l$  participation factors in the labor market. The implied participation factor for the native-born in (13) is 1. The magnitude of  $(\theta_y)_{-q}$  is likely to be lower than 1 for low values of  $q$ , larger than 1 for higher  $q$ 's, when immigrants invest in housing, for example, and it is expected to converge to 1 for sufficiently large  $q$ 's.

Equilibrium in the domestic good market requires:

$$Z_3 M_0^{\frac{(1-\alpha-\beta)(1+\lambda)}{\lambda(1-\alpha-\beta)+1-\beta}} (P_N + \overline{\Delta P_I \bar{\theta}_l})^{\frac{\alpha}{\lambda(1-\alpha-\beta)+1-\beta}} p_m^{\frac{-\beta(1+\lambda)}{\lambda(1-\alpha-\beta)+1-\beta}} = p_m^\varepsilon (P_N + \overline{\Delta P_I \bar{\theta}_y}), \quad (14)$$

and the solution for  $p_m$  is:

$$p_m = Z_4 M_0^{(1-\alpha-\beta)(1+\lambda)/\mu} (P_N + \overline{\Delta P_I \bar{\theta}_y})^{-[\lambda(1-\alpha-\beta)+(1-\beta)]/\mu} (P_N + \overline{\Delta P_I \bar{\theta}_l})^{\alpha/\mu}, \quad (15)$$

where  $\mu \equiv \beta(1 + \lambda) + \varepsilon\lambda(1 - \alpha - \beta) + \varepsilon(1 - \beta) > 0$ . Immigration has contradictory effects on the relative price. On the one hand, it raises the demand for goods and, thus, tends to lower  $p_m$  (increase the relative price of  $Y$ ), as indicated by the negative coefficient on the term containing  $\bar{\theta}_y$ . On the other hand, immigration increases labor supply and, thus, the supply of goods. Through this channel, immigration tends to increase  $p_m$ —via the positive coefficient on the term containing  $\bar{\theta}_l$ .<sup>7</sup>

The solution for native-born employment follows from the substitution of (15) into (11):

$$\frac{L_N}{P_N} = Z_5 M_0^{\lambda\varepsilon(1-\alpha-\beta)/\mu} P_N \left(1 + \frac{\overline{\Delta P_I}}{P_N} \bar{\theta}_y\right)^{\lambda\beta/\mu} P_N \left(1 + \frac{\overline{\Delta P_I}}{P_N} \bar{\theta}_l\right)^{-\lambda[\beta+\varepsilon(1-\alpha-\beta)]/\mu}. \quad (16)$$

The effect of immigrants' participation in the goods market is expressed by the positive coefficient on the term with  $\bar{\theta}_y$ , while the effect of immigrants' participation in the labor market is expressed by the negative coefficient on the term with  $\bar{\theta}_l$ .

An empirically convenient formulation can be obtained by taking logs of (16) and (15). Using the approximation  $\ln(1 + \frac{\overline{\Delta P_I}}{P_N} \bar{\theta}_i) \simeq \frac{\overline{\Delta P_I}}{P_N} \bar{\theta}_i$  for  $i = l, y$  yields:<sup>8</sup>

$$\ln \frac{L_N}{P_N} \simeq \ln Z_6 + \sum_{q=1}^{\infty} [\rho_1(\bar{\theta}_y)_{-q} - \rho_2(\bar{\theta}_l)_{-q}] \frac{(\overline{\Delta P_I})_{-q}}{P_N}, \quad (17)$$

$$\rho_1 = \lambda\beta/\mu > 0,$$

$$\rho_2 = \{\lambda[\beta + \varepsilon(1 - \alpha - \beta)]/\mu\} > 0,$$

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<sup>7</sup>If the model included a domestic component of  $M$ , immigration would affect the goods market and hence  $p_m$ , also via the investment demand for domestic goods. The implications for  $p_m$ , and for native employment, would be similar as those captured by the terms with  $\bar{\theta}_y$ , especially if investment of domestic goods is spread over time.

<sup>8</sup>This is a good approximation when  $\frac{\overline{\Delta P_I}}{P_N} \bar{\theta}_i$ ,  $i = l, y$ , is small enough relative to one. In the case under study, the accumulated immigration flows over the entire sample studied here reach less than 20% of the domestic population—and the  $\theta$  factors should be, on average, less than one. Therefore, the approximation seems reasonable.

$$Z_6 = Z_5 \frac{M_0}{P_N}^{\rho_2 - \rho_1},$$

$$\ln p_m \simeq \ln Z_7 - \sum_{q=1}^{\infty} [\omega_1(\theta_y)_{-q} - \omega_2(\theta_l)_{-q}] \frac{(\Delta P_I)_{-q}}{P_N}, \quad (18)$$

$$\omega_1 = \{[\lambda(1 - \alpha - \beta) + (1 - \beta)]/\mu\} > 0,$$

$$\omega_2 = \alpha/\mu_3 > 0,$$

$$Z_7 = Z_4 \frac{M_0}{P_N}^{\omega_2 - \omega_1}.$$

Consider first the case of perfect capital mobility, or  $1 - \alpha - \beta = 0$ . This implies that  $\rho_1 = \rho_2$  and  $\omega_1 = \omega_2$  and, thus, the effects of the immigration flows depend only on the difference  $(\theta_y)_{-q} - (\theta_l)_{-q}$ . If  $(\theta_y)_{-q} - (\theta_l)_{-q} > 0$ —i.e., the impact on goods demand (and, thus, on labor demand) dominates—the  $q$ -lag immigration flow is associated with a lower  $p_m$  (a higher relative price of  $Y$ ) and higher native-born employment. If  $(\theta_y)_{-q} - (\theta_l)_{-q} < 0$ , the current impact on labor supply (and, thus, on goods supply) dominates, and correspondingly, the  $q$ -lag immigration flow brings about a higher  $p_m$  (a lower relative price of  $Y$ ) and lower employment of native-born. Under perfect capital mobility, therefore, the effects of immigration depend only on the participation factors. This has two implications. First, in the special case that  $(\theta_y)_{-q} = (\theta_l)_{-q}$  for all  $q$ , the employment rate of the native-born and the relative price are not altered by immigration. This holds true because perfect capital mobility eliminates the standard labor substitution mechanism. Second, for each lag  $q$ , the effects of immigration on native employment and the relative price should have opposite signs.

When capital mobility is imperfect, direct labor substitution does take place. In this case  $1 - \alpha - \beta > 0$ , which implies that  $\rho_1 < \rho_2$  and  $\omega_1 > \omega_2$ . To stress the direct labor substitution mechanism in (17), assume for a moment that  $(\theta_y)_{-q} = (\theta_l)_{-q}$  for all  $q$ . Given that  $\rho_1 < \rho_2$ , immigration now has the standard negative impact on  $L_N/P_N$ . Regarding the relative price in (18), from  $\omega_1 > \omega_2$  it follows that immigration has negative effects on  $p_m$ .<sup>9</sup>

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<sup>9</sup>Compared with the case of perfect capital mobility, the decline in  $p_m$  follows from the partial adjustment of capital and other inputs, which restricts the supply of domestic goods.

When  $(\theta_y)_{-q} \neq (\theta_l)_{-q}$ , both labor substitution and differential participation operate, and the net effect depends on the relative strengths of the two mechanisms at each lag. The sign of the immigration effect on native employment at lag  $q$  depends on

$$\frac{(\theta_y)_{-q}}{(\theta_l)_{-q}} \text{ O } \frac{\rho_2}{\rho_1}.$$

If goods market participation is high enough, relative to labor market participation at the same lag, it can offset the labor supply substitution mechanism, represented by  $\rho_2/\rho_1 > 1$ . Higher  $(\theta_y)_{-q}$  relative to  $(\theta_l)_{-q}$  is also likely to cause an ‘‘appreciation,’’ or decline in  $p_m$ , which requires that

$$\frac{(\theta_y)_{-q}}{(\theta_l)_{-q}} > \frac{\omega_2}{\omega_1}.$$

Values of the ratio  $(\theta_y)_{-q}/(\theta_l)_{-q}$  can be divided into five intervals, each of which yields a different combination of effects in the two equations. Table 1 shows these intervals, from high to low relative participation in the goods market, and the corresponding signs of the effects.

Table 1

	$\frac{(\theta_y)_{-q}}{(\theta_l)_{-q}}$	$\frac{L_N}{P_N}$	$p_m$
I	$1 + \frac{\epsilon}{\beta}(1 - \alpha - \beta), \infty$	+	–
II	$\frac{1}{3} + \frac{\epsilon}{\beta}(1 - \alpha - \beta)$	=	–
III	$1 - \frac{(1+\lambda)(1-\alpha-\beta)}{\lambda(1-\alpha-\beta)+(1-\beta)}, 1 + \frac{\epsilon}{\beta}(1 - \alpha - \beta)$	–	–
IV	$\frac{1}{3} - \frac{(1+\lambda)(1-\alpha-\beta)}{\lambda(1-\alpha-\beta)+(1-\beta)}$	–	=
V	$0, 1 - \frac{(1+\lambda)(1-\alpha-\beta)}{\lambda(1-\alpha-\beta)+(1-\beta)}$	–	+

For example, interval I corresponds to a relative participation in the goods market that is high enough to generate a positive employment effect. The case of balanced participation (ratio equals one) is within interval III, where only labor substitution operates, leading to a negative employment effect along with an appreciation. In interval V, the labor substitution mechanism is reinforced by a depreciation, leading together to a negative employment effect.

Unlike the case of perfect capital mobility, in general there should not be a negative relationship between the effects on the two variables for each lag. Table 1 shows that in regions I and V the effects have opposite signs, but in region III both effects are the same (negative).

Note that the present formulation is consistent with no effect of the immigrant stock on native employment, as found in the literature. The stock of immigrants at a point in time includes flows for which  $\rho_1(\theta_y)_{-q} - \rho_2(\theta_l)_{-q}$  is positive and others for which this differential is negative. Hence, lumping together all lags may average out these differences. Disaggregating the flows stresses the aspect of time-since-migration and, thus, allows for short-run dynamic effects. In contrast, looking at the immigration stock provides a picture of the longer-run effects.

Finally, equation (5) implies that the real wage satisfies

$$w = \frac{L_N}{P_N} \uparrow_{1/\lambda},$$

i.e., the real wage should move together with the employment rate of the native-born.

## 4 Methodology and Data

The basic equations for estimation are based on the expressions for  $L_N/P_N$  and  $p_m$  in (17) and (18):

$$\ln \frac{L_{N,t}}{P_{N,t}} = a + bX_t + \sum_{q=1}^Q c_q \frac{\Delta P_{I,t-q}}{P_{N,t}} + \varepsilon_t, \quad (19)$$

$$\ln p_{m,t} = a' + b'X_t + \sum_{q=1}^Q c'_q \frac{\Delta P_{I,t-q}}{P_{N,t}} + \varepsilon'_t, \quad (20)$$

where  $X$  is a vector of controls (see below) and  $\varepsilon_t, \varepsilon'_t$  are error terms. The length of a period is taken as one quarter, and  $Q$  is the empirically relevant number of lags. The equations are jointly estimated using a SUR procedure to allow for correlation of the error terms.

The purpose of the estimation is to organize the data in the form of “impulse responses” (expressed by  $c_q, c_{q'}, q = 1, 2, \dots$ ) of the two endogenous variables to the immigration flows. According to the model, the coefficients have the form:

$$\begin{aligned} c_q &= \rho_1(\theta_y)_{-q} - \rho_2(\theta_l)_{-q}, \\ c'_q &= -\omega_1(\theta_y)_{-q} + \omega_2(\theta_l)_{-q}, \end{aligned} \tag{21}$$

$$\rho_1 = \lambda\beta/\mu > 0,$$

$$\rho_2 = \{\lambda[\beta + \epsilon(1 - \alpha - \beta)]/\mu\} > 0,$$

$$\omega_1 = \{\lambda(1 - \alpha - \beta) + (1 - \beta)\}/\mu > 0,$$

$$\omega_2 = \alpha/\mu > 0.$$

The structural parameters are not identified. However, given that  $\rho_1, \rho_2, \omega_1$  and  $\omega_2$  enter in the same way in  $c_q$  and  $c_{q'}$  for all  $q$ , the combinations of signs of these coefficients can trace, using Table 1, the relative strength of differential participation with the passage of time since migration.

A number of control variables are included to capture important macroeconomic developments not considered in the present model. First, a linear-quadratic time trend is included in both equations. In the relative price equation, the time trend is intended to capture the “Balassa-Samuelson” long-term decline in the relative price of imports, explained by technological change being biased towards tradeable goods. In the employment rate equation, the time trend is added to capture basic cyclical movements. Since the immigration influx started during a deep recession, one may expect, regardless of immigration, increasing employment with the ensuing upturn.

The security and political situation is an additional exogenous factor that may be important to control for, as it could affect both macroeconomic activity and immigration. The sample period includes the Gulf War and waves of severe terrorist attacks in 1994 and, particularly, in 1996, as well as the Oslo Accord with the Palestinians in 1993 and the peace treaty with Jordan in 1994. The instruments chosen to capture these events are: (i) inflows of tourists (*tourists*), and (ii) a political dummy variable (*d\_pol*) for the political party of

the Prime Minister in office. This variable takes the value of 1 when the prime minister is from the Labor Party (Prime Ministers Rabin, Peres, and Barak) and 0 when the prime minister is from the Likud Party (Prime Ministers Shamir and Netanyahu).

The choice of the number of tourists as an instrument reflects the assumption that personal security should have a much stronger effect on the desire to visit a country than do real exchange rate changes of the observed magnitude. The political dummy is intended to capture the feature that Labor-led governments tended to proceed faster than Likud-led governments with the peace process. An alternative interpretation of the political dummy is that the party in power reflects the security or political situation—i.e., when security deteriorates, the more militant party is elected.<sup>10</sup>

The chosen number of lags,  $Q$ , is 9 quarters, which seems a reasonably long period in the present context. Immigration flows prior to 1990, which were very small, are included so as not to shorten the sample with the number of lags. The coefficients on immigration lags are restricted to lie on a polynomial distributed lag (PDL), which imposes a parsimonious form on the impulse responses to immigration. The unrestricted form is also estimated.

The sample covers the period 1990-1999, at quarterly frequency. The immigration flows ( $\Delta P_I$ ) are taken from arrival records of working-age (15-64) immigrants from the former USSR. The labor force variables for the native-born—employment ( $L_N$ ) and working-age population ( $P_N$ )—are taken from the Labor Force Survey (also referring to the age group 15-64). The latter samples 11,400 households comprising 22,500 individuals (0.6% of the relevant population). The relative price of imports ( $p_m$ ) is the index of import prices in domestic currency divided by the deflator of business sector GDP.

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<sup>10</sup>The direction of the security situation effects on  $L_N/P_N$  and  $p_m$  depends on whether it influences more the demand side or the supply side of goods. If, for example, the main effect were on the production side, a better security situation should have positive effects on both variables.

## 5 Results

Regression analysis of the main relations is reported in Section 5.1. Section 5.2 addresses additional relevant evidence.

### 5.1 Regression Analysis

Table 2 presents the results of estimating equations (19) and (20). In the  $p_m$  equation, the world price of oil in dollars was added to capture the drastic price hike induced by the Gulf crisis, given that the resulting jump in the relative price of imports coincided with large immigration flows.

Table 2

Specification 1 is as discussed above, while in Specification 2 the insignificant control variables were deleted. In Specification 3, the PDL restriction on the immigration coefficients was not imposed. The coefficients on immigration in Specification 2 are plotted, along with the 95% confidence band, in Figure 3.<sup>11</sup>

Figure 3

The figure shows that the impulse response of native employment is slightly positive (but not significant) at the first two lags, is about zero at lag 3, and then turns negative from lag 4 onwards. The impulse response of the real exchange rate is positive at the first lag and then turns negative from lag 2 onwards (though it is significant only at lags 4 and 5).

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<sup>11</sup>The signs of the coefficients of  $d\_pol$  and  $tourists$  in Table 2 are positive in both equations. This suggests that worsening security disrupts production more than it reduces demand. The system estimated without  $d\_pol$  and  $tourists$  is reported in the appendix, Table A1, Specification 1. The fit of the equations is poorer than in the basic equations, but the impulse responses of immigration are similar.

In terms of Table 1, these responses can be seen as follows. At the first lag both responses are positive, inconsistent with the regions in Table 1, but highly insignificant. From the second lag onwards, the interpretation of the two impulse responses is that lag 2 is in region I (positive effect for  $L_N/P_N$  and negative for  $p_m$ ), lag 3 is in region II (zero for  $L_N/P_N$  and negative for  $p_m$ ), and lag 4 and onwards are in region III (negative for both  $L_N/P_N$  and  $p_m$ ).<sup>12</sup>

The main point is that the impulse responses can be interpreted as a downward movement along the regions of Table 1—i.e., a decline in the relative participation in the goods market with the length of stay. More specifically, the process can be described as follows. For two or three quarters after arrival, immigrants' participation in the goods market is the highest. Therefore, the ensuing increase in labor demand—due to the decline in  $p_m$ —dominates, or exactly offsets, the direct substitution effect. Hence,  $L_N/P_N$  increases or stays the same. With additional lags, the relative participation of immigrants in the goods market goes down, and then the labor demand effect—still caused by a decline in  $p_m$ —is dominated by the direct substitution effect, leading to a lower  $L_N/P_N$ .

The importance of the direct substitution effect in the interpretation implies that the results are consistent with imperfect capital mobility (i.e.,  $1 - \alpha - \beta > 0$ ). This is so because, as discussed in Section 3, when capital mobility is perfect, the direct substitution effect is eliminated. Thus, the only effect on employment comes from the change in  $p_m$  in the opposite direction—the effect working via labor demand. Hence, if capital mobility were perfect, the two impulse responses should have been mirror images of each other around the zero line.

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<sup>12</sup>The model was also estimated with total immigration flows—i.e., including immigration from outside the former Soviet Union. Over the sample period 1990:1-1999:4, immigrants from the former Soviet Union at working age amount to about 80 percent of total immigrants in this age range. The exogeneity of the additional flows is much more questionable than those from the former Soviet Union. However, the results and impulse responses remain very similar to those reported in Table 2.

In terms of the main question in the related literature, the results indicate that significant negative effects of immigration on native-born employment occur only from the fourth lag onwards—i.e., with a delay of a year after immigration. The stock of immigrants,  $P_I/P_N$ , when added to the regressions, has highly insignificant coefficients in the two equations. The other results remain unchanged. The lack of significance of the stock of immigrants suggests that the negative effects of immigration are temporary.

In order to check the robustness of the results, we tried other modifications of the basic specifications. First, unilateral transfers from abroad increase the supply of foreign exchange, and government spending affects the demand for goods. Hence, these two variables, which increased during the large immigration period, can potentially have an impact on the real exchange rate and, thus, on native employment. To test this possibility, unilateral transfers from abroad, in US dollars, and the government spending/GDP ratio were added to the regressions, but they turned out to be insignificant, without altering the other results.

Additionally, the sample period was extended backwards to the pre-immigration period, and the impulse responses were estimated over the period 1988:1-1999:4. The resulting impulse responses—reported in the appendix, Table A1 and Figure A2—remain similar to the basic ones.<sup>13</sup>

Beyond the interpretation of the results using Table 1, one may carry out an exercise to illustrate the macroeconomic effect working through the relative price. The degree to which the relative price changes in the second panel of Figure 3 mitigate or delay the decline in  $L_N/P_N$ , shown in the first panel of Figure 3, can be calculated using equation (11), where  $L_N/P_N$  is a function of  $p_m$ , and assuming reasonable parameter values for the coefficient of

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<sup>13</sup>Extending the sample backwards, prior to 1990, is somewhat problematic given the presence of a strong cyclical pattern in a period of negligible immigration. In the years 1988-1989, economic activity had a declining pattern after the boom that followed the 1985 stabilization plan—which stopped hyper-inflation. The inclusion of 1988-1989 in the sample requires capturing this additional cyclical episode. In the 1988:1-1999:4 regression reported in the appendix, this is done by extending the time trend to a third-degree polynomial.

$p_m$  in this equation. If  $\lambda = 1$ ,  $\alpha = 0.6$ ,  $\beta = 0.3$ , this coefficient equals  $-0.375$ , implying that for each percentage point appreciation,  $L_N/P_N$  increases 0.375 percent. Using this coefficient, one may construct an hypothetical impulse response for native employment that holds  $p_m$  constant, and corresponds, in the notation of equation (21), to  $c_q - (-0.375)c'_q$ ,  $q = 1, \dots, 9$ —where  $c_q$  and  $c'_q$  are the “basic” impulse responses, taken from Specification 2 in Table 2 and plotted in Figure 3.<sup>14</sup> This line (“constant relative price”) is plotted in Figure 4, along with the “basic” impulse response. The vertical distance between the “basic” line and the “constant relative price” line depends on the parameter values assumed. Qualitatively, however, Figure 4 indicates that without the macroeconomic effect via the relative price, native employment would have reacted more negatively to immigration (except for the first lag).

Figure 4

Figure 5 summarizes the effects of immigration on the native-born employment rate during the sample. The “no immigration” line is the actual employment rate less the immigration effects, i.e., the exponent of  $\ln \frac{L_{N,t}}{P_{N,t}} - \sum_{q=1}^Q c_q \frac{\Delta P_{1,t-q}}{P_{N,t}}$ , where the  $c_q$ s are the coefficients in the “basic” impulse response. The vertical difference between the “no immigration” and the “actual” lines represents the estimated marginal contribution of the immigration influx. The largest negative effect of immigration occurs in the third quarter of 1992, when the actual native-born employment rate is 2.6 percentage points below its predicted rate. The average such difference over the sample is 1 percentage point. Given that these are percentages out of the working age population, and not out of the labor force, they are quite

<sup>14</sup>The expression  $c_q - (-0.375)c'_q$  can be written as:

$$\frac{d(L_N/P_N)}{d(\Delta P_{1,-q}/P_N)} - \frac{d(L_N/P_N)}{dp_m} \frac{dp_m}{d(\Delta P_{1,-q}/P_N)} \equiv \frac{d(L_N/P_N)}{d(\Delta P_{1,-q}/P_N)} \Big|_{p_m = \text{constant}}$$

where  $\frac{d(L_N/P_N)}{d(\Delta P_{1,-q}/P_N)} = c_q$ ,  $\frac{d(L_N/P_N)}{dp_m} = -0.375$ , and  $\frac{dp_m}{d(\Delta P_{1,-q}/P_N)} = c'_q$ .

sizeable.<sup>15</sup>

Figure 5 includes also the “constant relative price” line, using the computation above to control for relative price changes. This line can be interpreted as the hypothetical employment rate for a constant  $p_m$ , under the parameter assumptions made, and it is defined as the exponent of  $\ln \frac{L_{N,t}}{P_{N,t}} - (-0.375) \prod_{q=1}^Q c'_q \frac{\Delta P_{I,t-q}}{P_{N,t}}$ . As in the discussion of Figure 4, the vertical distance between the “actual” and “constant relative price” lines depends on the parameter values assumed. Qualitatively, however, the employment rate with a constant relative price declines more and sooner than the actual rate, illustrating the moderating effect of the appreciation on native-born employment implied by the model.

Figure 5

## 5.2 Additional Evidence

A key element in the present analysis is the participation of immigrants in the labor and the goods markets, as captured by the participation factors  $(\theta_y)_{-q}$  and  $(\theta_l)_{-q}$ . In particular, the empirical results were interpreted to imply that  $(\theta_y)_{-q}$  is high relative to  $(\theta_l)_{-q}$  for low values of  $q$ , declining thereafter. Given the importance of differential participation for the present analysis, we present here some partial but direct evidence on these participation factors. First, the ratio of employed immigrants to immigrants in the labor force, as a function of quarters since arrival, can provide an indication of the evolution of  $(\theta_l)_{-q}$  with  $q$ .<sup>16</sup>

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<sup>15</sup>If all the reduction in native-born employment accrued to unemployment, the partial contribution of immigration to the total unemployment rate (out of the labor force) would be 3.9 percentage points in 1992:3 and 1.4 percentage points on average. For comparison, the unemployment rate was 12 percent in 1992:3 and 8.5 percent on average.

<sup>16</sup>We thank Sarit Cohen for kindly providing these data, produced from the Labor Force Survey. The data refer to immigrants who arrived between late 1989 and early 1992, aged 23-58 at arrival. Note that labor participation in the context of this paper implies actual employment—i.e., it has an impact on the supply of goods, rather than participation in the usual sense, which includes unemployment and training. The ratio

Second, in order to measure the evolution of  $(\theta_y)_{-q}$  with  $q$ , direct evidence on immigrants' participation in the goods market—in terms of consumption and residential investment—is needed. This evidence is more problematic to obtain because available data are aggregate—i.e. they include the native population. Consumption and residential investment of the native population are affected negatively by immigration via relative price changes triggered by immigration. In the model, productive investment goods are imported (as a part of  $M$ ), but, in reality, part of such investment goods is home-produced. Therefore, productive investment due to immigration should have an additional crowding-out effect on natives' consumption. Hence, the reduced-form effect of immigration on total consumption and residential investment is, in principle, ambiguous. Focusing only on residential investment is less problematic in this respect, given that new immigrants' share in the demand for housing should be much larger than the corresponding share in consumption. Additionally, the presumption is that immigrants' housing investment is likely to be less smooth than consumption. Hence, it reflects well the dynamic pattern of immigrants' total participation in the goods market during the first two or three years after arrival. Accordingly, the procedure adopted is based on the following equation for total housing investment  $I_t$ :

$$I_t = aX_t + (\hat{\theta}_y)_0 \Delta P_{I,t} + (\hat{\theta}_y)_{-1} \Delta P_{I,t-1} + \dots,$$

where  $(\hat{\theta}_y)_{-q}$  represents current residential investment of an immigrant who is  $q$  periods after arrival—whose pattern is expected to reflect the pattern of  $(\theta_y)_{-q}$ —and  $X_t$  is the vector of control variables included previously. These coefficients, estimated in PDL form with quarterly data over the 1990:1-1999:4 sample, are plotted in Figure 6, along with the data on labor participation factors described above.<sup>17</sup>

Figure 6

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employment/working-age population would be a more precise indicator for  $(\theta_1)_{-q}$ , but these ratios are not available as a function of time since arrival.

<sup>17</sup>The regression is reported in the appendix, Specification 3 in Table A1.

As Figure 6 shows, the estimated coefficients of participation in the goods market begin to be significant at the 2nd quarter after arrival, and remain so until the 6th quarter, having a general declining pattern. Labor participation, in contrast, increases monotonically with time from arrival. Note that this behavior is consistent with the interpretation of the impulse responses in Figure 3 as a downward movement along the regions of Table 1—i.e., that the relative participation in the goods market declines with time since arrival.

An additional aspect of the model that it is interesting to confront with the data is the behavior of the real wage. Equation (4) implies that  $w$  should have a (perfect) positive correlation with the native employment rate (in log terms). Note that this positive comovement reflects both mechanisms addressed in this paper: (1) differential participation (stronger in the goods market) increases labor demand, leading to both higher real wages and native employment; and (2) direct labor substitution, triggered by increasing total labor supply, generates both lower  $w$  and  $L_N/P_N$ . These two variables, plotted in Figure 7, display, as predicted, a positive correlation (0.6).<sup>18</sup>

Figure 7

## 6 Conclusions

The paper examines the effects of mass immigration to Israel during the 1990s on the employment rates of the native-born. Studying the immigration influx to Israel from the former Soviet Union has two important advantages from both the analytical and econometric points of view. The first is the exogenous nature of this immigration influx, which allows the use of reasonably exogenous explanatory variables. The second is that looking at a national economy diminishes to a large extent the bias generated by internal native migration to

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<sup>18</sup>The variables are logged and detrended. The available real wage data include immigrants, who entered low-wage occupations first [see Eckstein and Weiss (1998)]. Hence, the aggregate wage series—used in Figure 7—is biased downwards, mainly at the beginning of the sample, relative to the relevant wage for native-born.

other areas, which may arise when studying immigration to a particular area of a national economy.

The analysis is carried out within a general equilibrium model that focuses on the macroeconomic effects of immigration on native employment. The model takes into account dynamic effects on both labor supply and labor demand induced by immigration through gradual and differential entry into the labor and the goods markets. These features cannot be dealt with in a partial labor-market equilibrium setup, or using immigration stock data. In particular, the present analysis uncovers an early effect of immigration working through the demand for goods and an increase in the relative price of domestic goods (a real appreciation). The negative employment effect appears only later, with a delay of about a year following arrival.

## References

- [1] Altonji, Joseph G. and David Card, 1991. "The Effects of Immigration on the Labor Market Outcomes of Less-Skilled Natives," in J.M. Abowd and R.B.Freeman (eds.). *Immigration, Trade and the Labor Market*, University of Chicago Press, (Chicago), 201-234.
- [2] Borjas, George J., 1994. "The Economics of Immigration," *Journal of Economic Literature* XXXII, 1667-1717.
- [3] Borjas, George J., Richard B. Freeman and Lawrence F. Katz, 1997. "How Much Do Immigration and Trade Affect Labor Market Outcomes?" *Brookings Papers on Economic Activity* 1, 1-90.
- [4] Bruno, Michael and Jeffrey D. Sachs, 1985. *Economics of Worldwide Stagflation*. Basil Blackwell, (Oxford).
- [5] Card, David, 1990. "The Impact of the Mariel Boatlift on the Miami Labor Market," *Industrial and Labor Relations Review*, 43(2), 245-257.
- [6] Eckstein, Zvi and Ron Shachar, 1996. "On the Transition to Work of New Immigrants: Israel 1990-1992," mimeo.
- [7] Eckstein, Zvi and Yoram Weiss, 1998. "The Absorption of Highly Skilled Immigrants: Israel, 1990-1995", mimeo.
- [8] Friedberg, Rachel M., 1997. "The Impact of Mass Migration on the Israeli Labor Market," PSTC Working Paper #97-11, Brown University.
- [9] 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.

- [10] Zimmermann, Klaus F., 1995. "Tackling the European Migration Problem," *Journal of Economic Perspectives* 9(2), 45-62.

Table 2

	(1) PDL		(2) PDL		(3) Unrestricted	
	$\ln \frac{L_{N,t}}{P_{N,t}}$	$\ln p_{m,t}$	$\ln \frac{L_{N,t}}{P_{N,t}}$	$\ln p_{m,t}$	$\ln \frac{L_{N,t}}{P_{N,t}}$	$\ln p_{m,t}$
Constant	-0.73* (0.01)	0.11* (0.04)	-0.74* (0.01)	0.12* (0.03)	-0.74* (0.01)	0.13* (0.03)
time	0.007* (0.001)	-0.007* (0.002)	0.008* (0.001)	-0.006* (0.002)	0.008* (0.001)	-0.006* (0.002)
time <sup>2</sup> × 10 <sup>2</sup>	-0.011* (0.001)	-0.001 (0.003)	-0.012* (0.001)	-0.002 (0.003)	-0.012* (0.001)	-0.001 (0.003)
price of oil		0.003* (0.001)		0.003* (0.001)		0.003* (0.001)
tourists	5.93* (2.80)	7.81 (8.75)	9.13* (2.19)		9.63* (2.23)	
d_pol	0.007 (0.004)	0.029* (0.011)		0.034* (0.008)		0.036* (0.008)
$\frac{\Delta P_{I,t-1}}{P_{N,t}}$	-0.12 (0.66)	2.47 (2.07)	0.33 (0.59)	1.12 (1.51)	2.39 (2.39)	4.47 (5.91)
$\frac{\Delta P_{I,t-2}}{P_{N,t}}$	0.11 (0.22)	0.00 (0.65)	0.26 (0.21)	-0.41 (0.51)	0.66 (2.22)	2.40 (5.76)
$\frac{\Delta P_{I,t-3}}{P_{N,t}}$	0.07 (0.25)	-1.26 (0.73)	0.03 (0.25)	-1.17 (0.74)	-1.86 (2.25)	-11.90 (6.17)
$\frac{\Delta P_{I,t-4}}{P_{N,t}}$	-0.15 (0.21)	-1.64* (0.65)	-0.28 (0.21)	-1.38* (0.61)	0.09 (2.25)	2.20 (6.09)
$\frac{\Delta P_{I,t-5}}{P_{N,t}}$	-0.49* (0.13)	-1.43* (0.39)	-0.62* (0.15)	-1.23* (0.36)	0.01 (2.26)	-12.50* (6.21)
$\frac{\Delta P_{I,t-6}}{P_{N,t}}$	-0.86* (0.20)	-0.96 (0.57)	-0.92* (0.24)	-0.95 (0.59)	-5.78* (2.22)	2.70 (6.34)
$\frac{\Delta P_{I,t-7}}{P_{N,t}}$	-1.17* (0.26)	-0.55 (0.79)	-1.12* (0.33)	-0.73 (0.73)	-3.50 (2.25)	-0.02 (6.38)
$\frac{\Delta P_{I,t-8}}{P_{N,t}}$	-1.35* (0.22)	-0.52 (0.64)	-1.16* (0.35)	-0.80 (0.44)	-3.82 (2.08)	-7.82 (5.95)
$\frac{\Delta P_{I,t-9}}{P_{N,t}}$	-1.33* (0.45)	-1.17 (1.31)	-0.97 (0.62)	-1.36 (1.32)	-3.46 (1.91)	-4.26 (5.41)
R <sup>2</sup>	0.94	0.95	0.93	0.95	0.94	0.96
D.W.	1.62	2.34	1.70	2.26	1.72	2.07

## Notes:

1. tourists: number of tourists.  
d\_pol: political dummy variable taking the value 1 when the prime minister in office is from the Labor Party, and 0 when the prime minister is from the Likud Party.
2. Standard errors are in parentheses. Coefficients significant at the 5% level are denoted by an asterisk.
3. The regression sets are estimated using SUR. The regressions entitled “PDL” are estimated using a 3rd order PDL.
4. Sample period: 1990:I - 1999:IV. The lags of the immigration flows do not shorten the sample as they go back to the relevant periods prior to the sample.

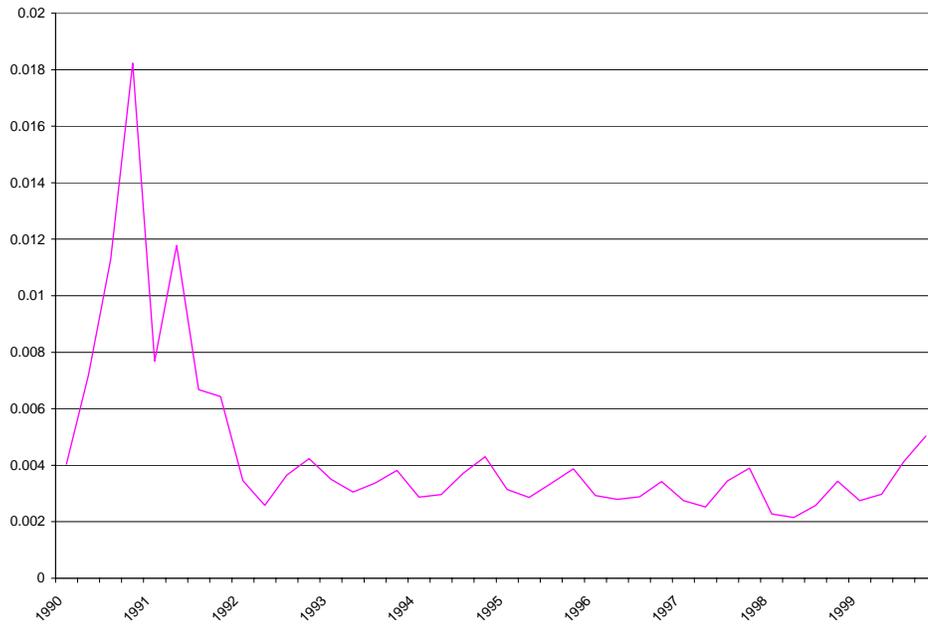


Figure 1: Immigration Flows (Fraction of Native Working-Age Population)

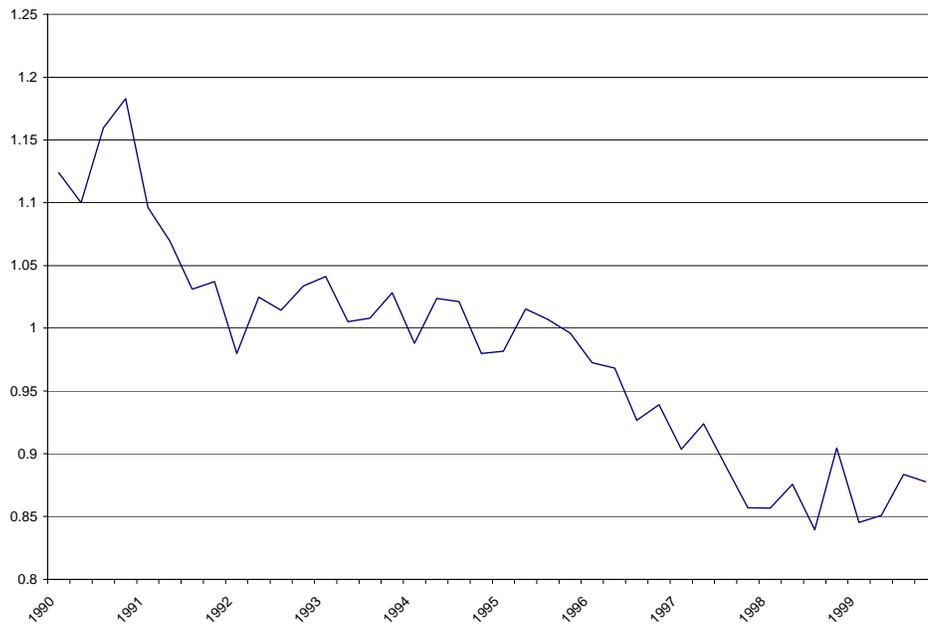
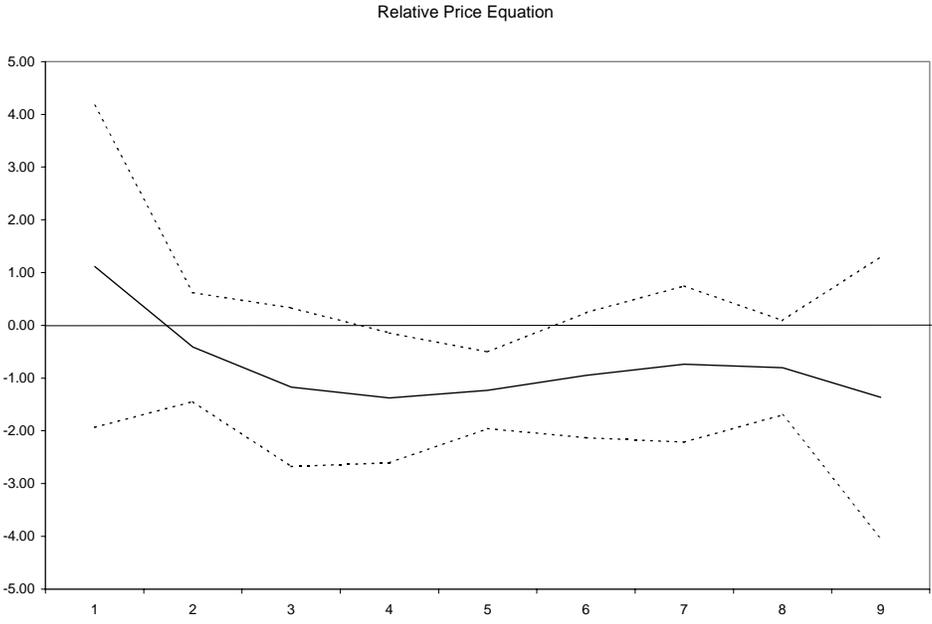
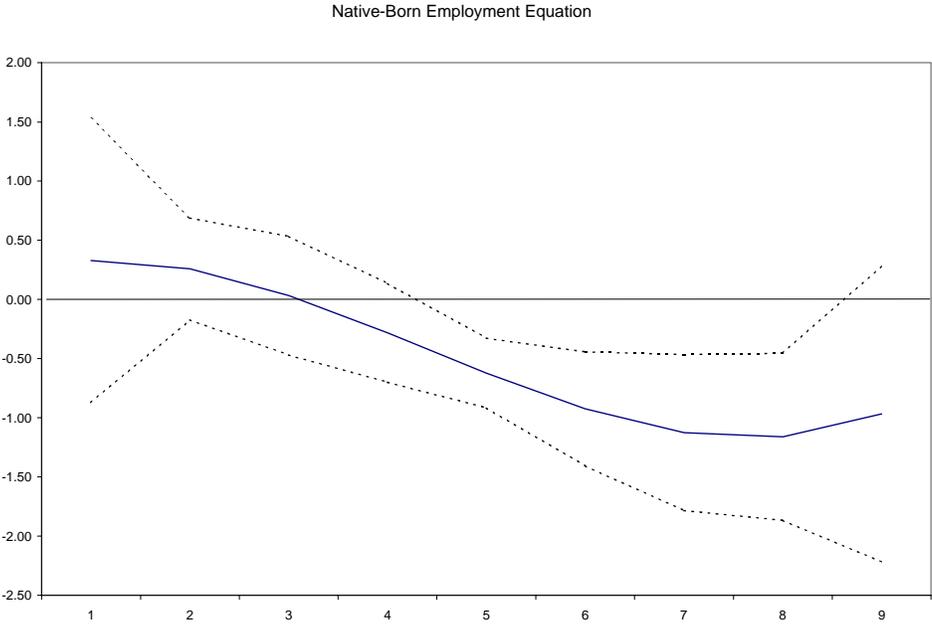


Figure 2: Relative Price of Imports

Figure 3: Coefficients of Immigration Flows –Table 2 - Specification 2  
(with 95% confidence bands)



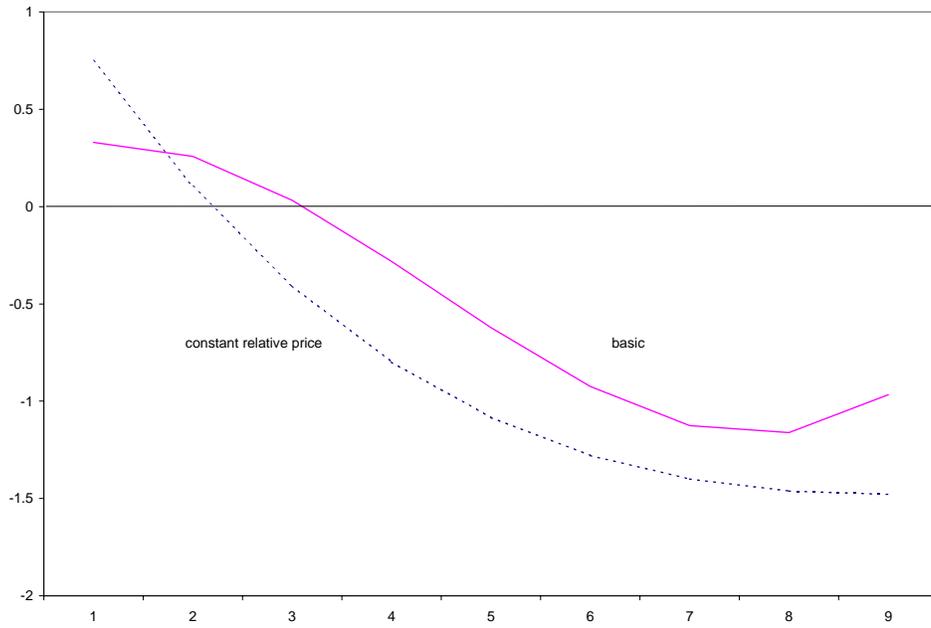


Figure 4: Coefficients of Immigration Flows in the Employment Equation

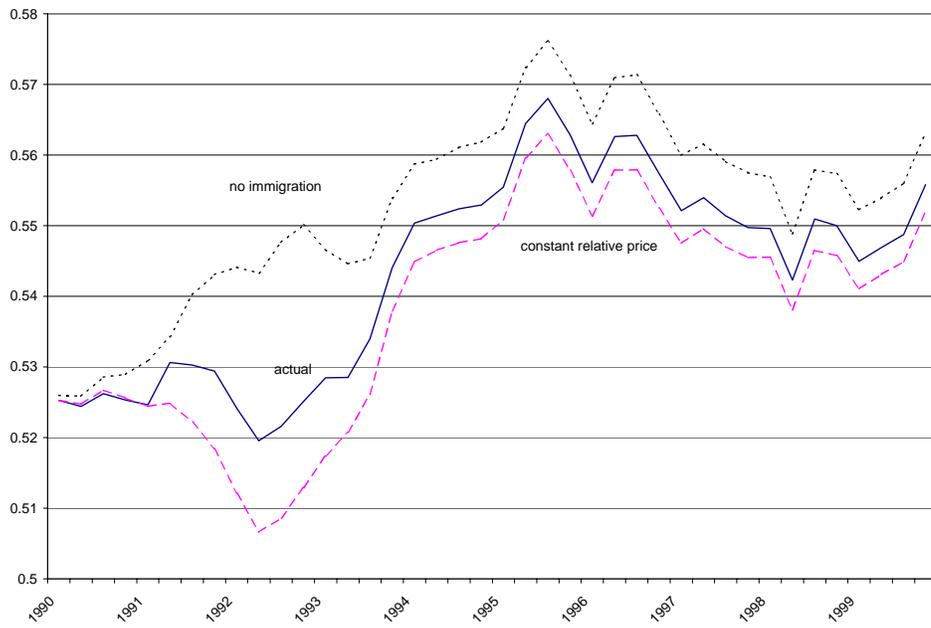


Figure 5: Native-Born Employment (Fraction of Working-Age Population)

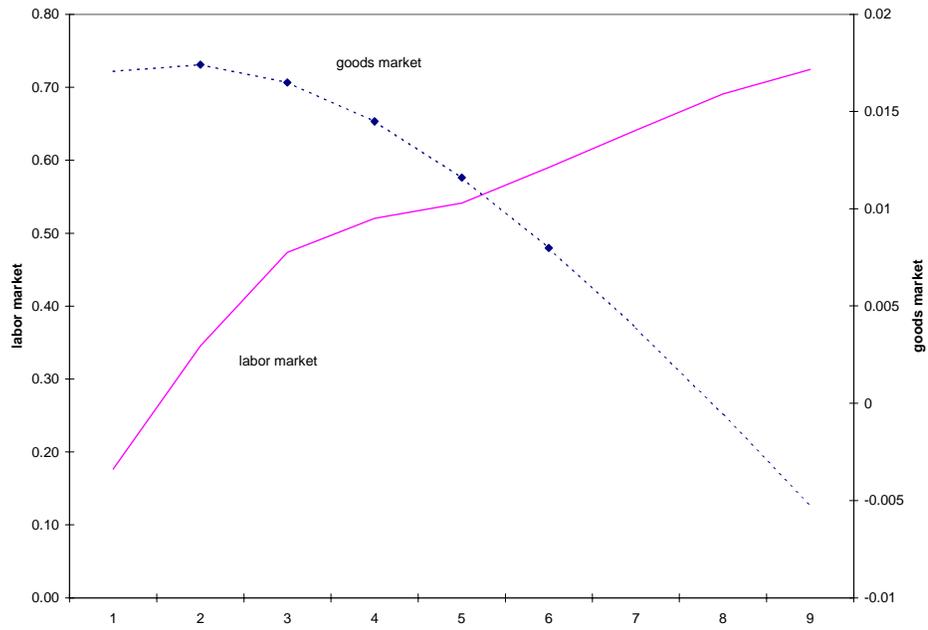


Figure 6: Participation Factors

Note: The marked coefficients in the “goods market” line are significant at the 5% level. See Specification 3 in the appendix.

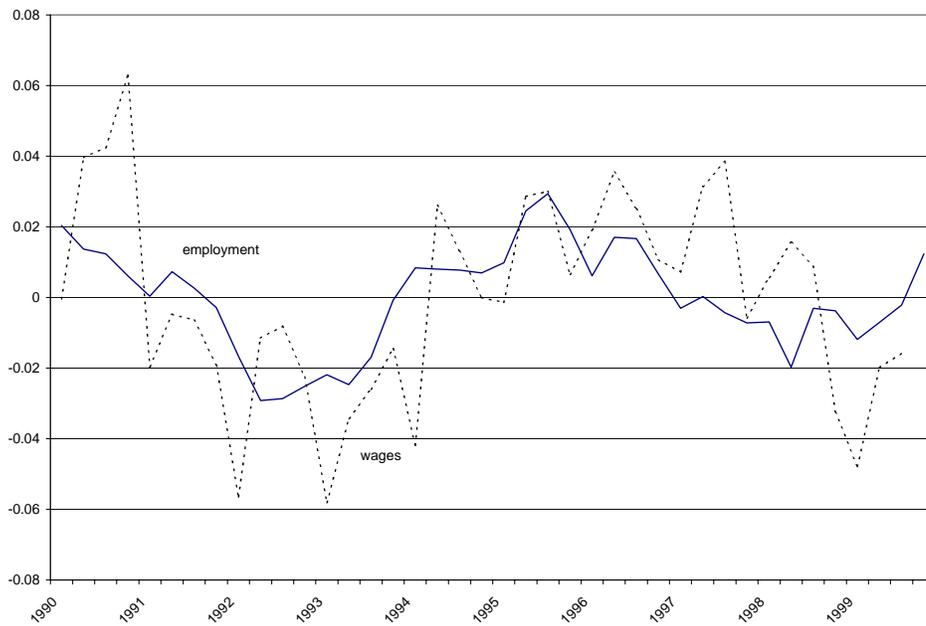


Figure 7: Detrended Log Native Employment Rate and Real Wages

# Appendix

Table A1

	(1)		(2)		(3)
	$\ln \frac{L_{N,t}}{P_{N,t}}$	$\ln p_{m,t}$	$\ln \frac{L_{N,t}}{P_{N,t}}$	$\ln p_{m,t}$	$I_t$
Constant	-0.71* (0.01)	0.12* (0.04)	-0.63* (0.01)	0.05 (0.03)	-768 (654)
time	0.009* (0.001)	-0.003 (0.002)	-0.006* (0.001)	-0.005* (0.002)	213* (37)
time <sup>2</sup> × 10 <sup>2</sup>	-0.013* (0.001)	-0.007 (0.004)	0.038* (0.005)	-0.005 (0.003)	-3.33* (0.60)
time <sup>3</sup> × 10 <sup>4</sup>			-0.054* (0.006)		
price of oil		0.002* (0.001)		0.004* (0.001)	
tourists			3.29 (2.61)	10.48 (9.24)	3.22* (1.50)
d_pol			0.018* (0.04)	0.022 (0.012)	-691* (201)
$\frac{\Delta P_{I,t-1}}{P_{N,t}}$	-1.05 (0.60)	1.25 (1.79)	-0.29 (0.32)	2.77 (4.20)	0.017 (0.012)
$\frac{\Delta P_{I,t-2}}{P_{N,t}}$	-0.25 (0.21)	-0.55 (0.61)	0.38* (0.05)	0.12 (0.47)	0.017* (0.004)
$\frac{\Delta P_{I,t-3}}{P_{N,t}}$	0.01 (0.30)	-1.51 (0.88)	0.52* (0.06)	-1.26 (0.72)	0.016* (0.005)
$\frac{\Delta P_{I,t-4}}{P_{N,t}}$	-0.12 (0.24)	-1.82* (0.72)	0.30 (0.04)	-1.71* (0.55)	0.014* (0.004)
$\frac{\Delta P_{I,t-5}}{P_{N,t}}$	-0.48* (0.15)	-1.65* (0.42)	-0.14* (0.02)	-1.53* (0.24)	0.012* (0.003)
$\frac{\Delta P_{I,t-6}}{P_{N,t}}$	-0.91* (0.24)	-1.19 (0.70)	-0.64* (0.04)	-1.05* (0.45)	0.008* (0.004)
$\frac{\Delta P_{I,t-7}}{P_{N,t}}$	-1.26* (0.31)	-0.64 (0.90)	-1.05* (0.06)	-0.59 (0.72)	0.004 (0.005)
$\frac{\Delta P_{I,t-8}}{P_{N,t}}$	-1.37* (0.20)	-0.17 (0.59)	-1.21* (0.04)	-0.48 (0.43)	-0.001 (0.004)
$\frac{\Delta P_{I,t-9}}{P_{N,t}}$	-1.08* (0.53)	0.02 (1.56)	-0.97* (0.22)	-1.02 (2.56)	-0.005 (0.009)
R <sup>2</sup>	0.90	0.93	0.93	0.95	0.85
D.W.	0.80	1.61	1.69	1.94	1.55

## Notes:

1. Standard errors are in parentheses. Coefficients significant at the 5% level are denoted by an asterisk.
2. Specification 1 excludes the variables  $d_{pol}$  and  $tourists$ , which instrument for the political and security situation. It is estimated using SUR and a 3rd order PDL. Sample period: 1990:I-1999:IV.
3. Specification 2 uses the extended sample 1988:I-1999:IV. It is estimated using SUR and a 3rd order PDL.
4. Specification 3.  $I_t$ : residential investment. The immigration flows are not divided by the population. It is estimated using a 3rd order PDL. Sample period: 1990:I-1999:IV. Note that the tourist inflow has a positive coefficient, as can be expected from its interpretation as reflecting the security situation. The coefficient of the political dummy, however, is negative. A possible explanation is that housing construction in settlements in the occupied territories tends to be larger under Likud administrations.
5. The lags of the immigration flows do not shorten the sample as they go back to the relevant periods prior to the sample.

Figure A1: Coefficients of Immigration Flows – Specification 1 - Table A1  
(with 95% confidence bands)

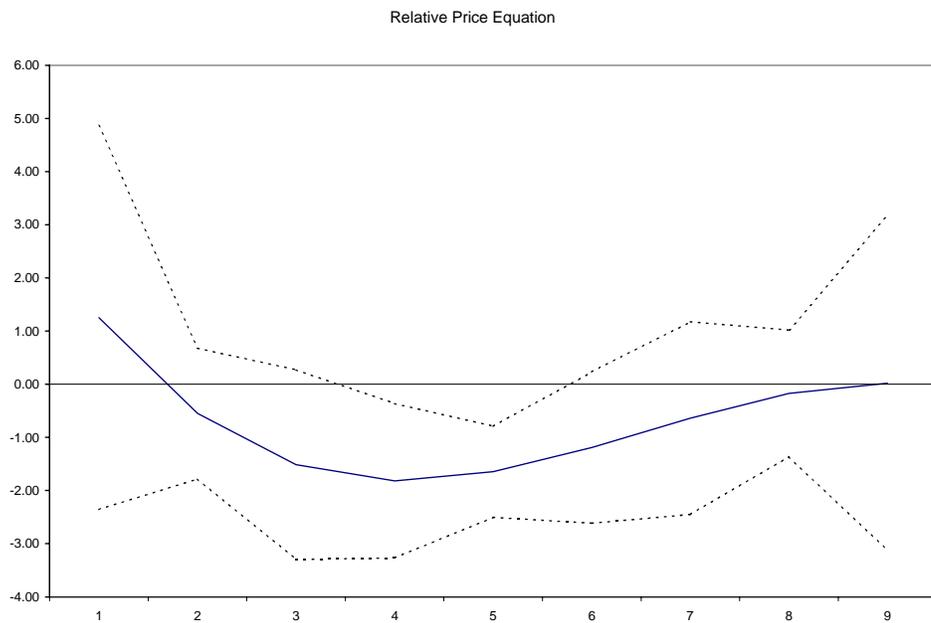
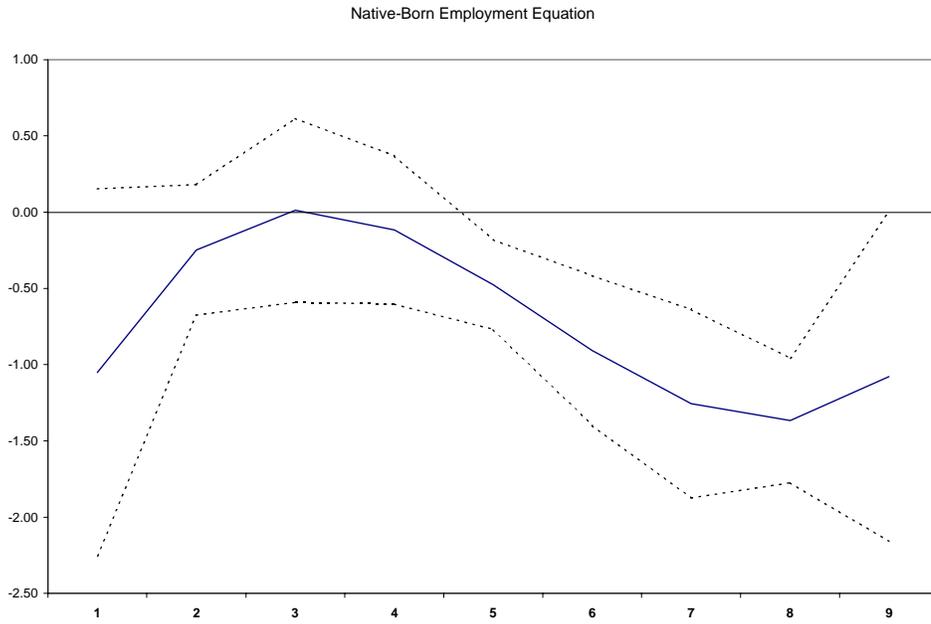


Figure A2: Coefficients of Immigration Flows – Specification 2 - Table A1  
(with 95% confidence bands)

