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Session III – Supporting paper

**CHECK AND RECOVER:  
FOREIGN WORKERS<sup>1</sup> DEPARTURES MODEL**

Submitted by the Central Bureau of Statistics, Israel<sup>2</sup>

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<sup>1</sup> The contents of the paper relate exclusively to the documented foreign workers, namely those who entered Israel with a work permit or obtained it shortly after arrival.

<sup>2</sup> Paper prepared by Laura Staetsky

## Introduction<sup>1</sup>

This work aims at the implementation of a technique in the sphere of migration dynamics analysis similar in its utility and applicability to the life table in mortality analysis.

The idea of social events being governed by the (supreme) laws is not new. Although, the attempt to present these laws as regularities that can be expressed with the help of mathematical tools begins in the seventeenth century.

The first life table was computed by John Graunt, “citizen of London”, in his search for the “laws” of mortality. In modern demographic analysis the idea of “model mortality” was further developed by A. Coale and P. Demeny. Additionally to its function as a mortality regime model, the life table and an underlying idea of survival analysis became a major methodological tool for dealing with data quality issues. It made it possible to :

1. check data quality, by comparing with a model; and
2. recover data under standard assumptions.

The power of mortality analysis is based on the inevitability and conceptual clarity of the underlying process. Migration does not offer such clarity; it is a purely social process without almost no biological determinants. This quality of migration processes has a confounding effect on the potential development of methodological tools. Migration has always been a “step-child” of demography. The ways in which it shapes population change and interacts with fertility and mortality are far from being clear-cut and unambiguous.

Therefore, any technique of migration analysis (apart from the most basic) will necessarily be situational, i.e. depending on characteristics of the specific migration context. The suggested model depends heavily on the Israeli migration context or, rather, on Israeli migration data collection. Israeli foreign labor statistics depends on the Border Control system (the BC system) as its primary resource. The Israeli Border Control system has been known for its comprehensive nature. However, during the nineties it went through a severe crisis due to the increasing volume of border crossings and tardiness of system-upgrading activities. Its previous capacity to give a credible picture of stocks and flows of foreigners was damaged. As a result, in order to use it as a meaningful source for statistical purposes, the task of “check and recovery” became an imperative.

The purpose of this paper is:

1. to examine the numerical regularities of the foreign labor phenomenon in Israel and its reflection in the registration activities of the BC system;
2. to present the problematic developments in the BC system and the problematic nature of the recent data;
3. to propose a solution to the problem, with the help of a method based on identification of the “normal” regularities versus deviating patterns;
4. to use a different data source-the National Insurance Institute-to evaluate the solution.

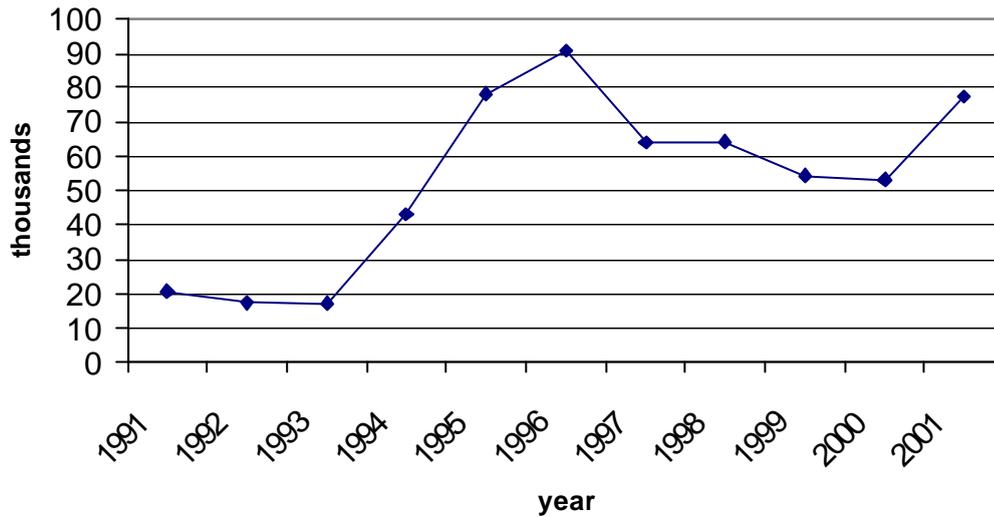
## The Background

Israel did not attract international labor migrants up until the nineties. When they were first permitted to arrive in significant numbers –in the mid-nineties-they were meant to replace Palestinians from the territories of the West Bank and Gaza Strip whose presence was perceived as a security threat. The number of foreign residents entering Israel with work permits increased to 78,000 in 1995 and by 14% between 1995 and 1996 (to 91,000 entries per year). As a result of the compromise that was reached between the Israeli government and representatives of employers’ bodies, the number decreased by 30% -40%, fluctuating between 53,000 and 64,000 per year in 1997-2000. In 2001, the level of 78,000 entries per year was reached again.

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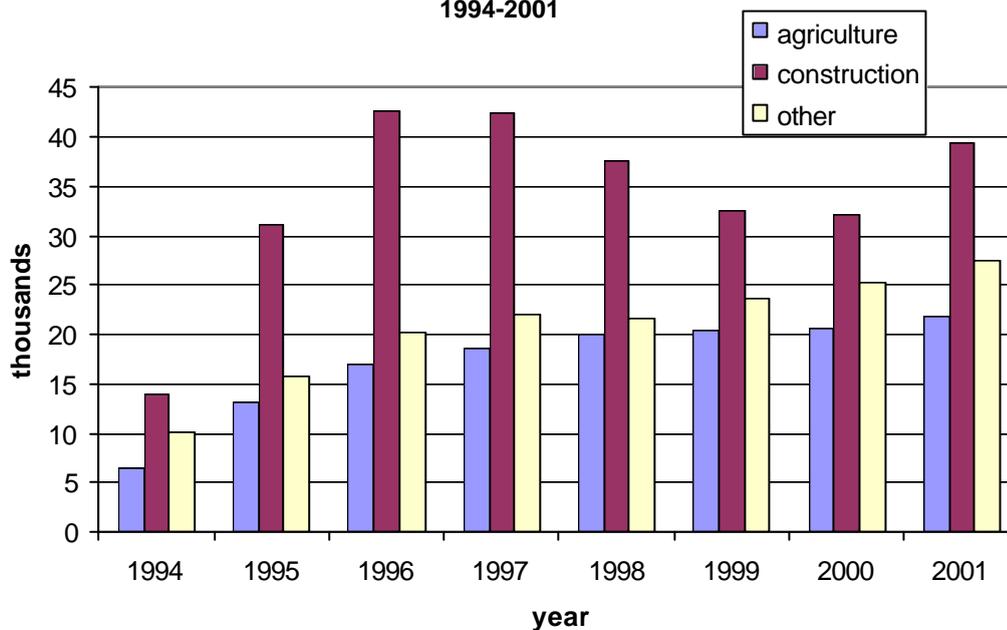
<sup>1</sup> The author feels indebted to Mr. Ari Paltiel, Senior Deputy, Social and Welfare Statistics, CBS-Israel and the late Ms. Dorith Tal, a former Head of Immigration Division, CBS-Israel, for their useful remarks and constant encouragement.

**Figure 1. Arrivals of work permit holders to Israel in 1991-2001**



There are three main areas of employment for foreign workers in Israel: construction, agriculture and domestic service.

**Figure 2. Employee posts of foreign workers by economic activities in 1994-2001**



Construction and agriculture had been heavily dependent on the Palestinian labor force up until the mid-nineties, whereas in domestic service the dependence on foreign labor of non-Palestinian origin was already well-established by the beginning of nineties.

### The Problem

Israeli statistics on both on stocks and flows of foreign workers relies on the Border Control system. Data on flows are used as a source for simple arrival and departure counts as well as a source for demographic characteristics of foreign workers (age, sex, country of citizenship). Data on stocks are used for the end of year estimates of the size of the population of foreign workers.

The main problem with data on stocks is the existence of cumulative error, inflating the population size. The error is an intrinsic feature of the Border Control system. It originates from imperfect registration of arrivals and departures and necessitates corrections (namely, neutralization of the system-error) of “raw” stocks data.

Theoretically, data on stocks could be produced on the basis of flows. We prefer to rely on separate counts of both stocks and flows for the end of year estimations. The two types of data were compared and adjusted, consistency being the major quality-check tool.

Until the end of 1998, registration of foreign workers in Israel was not separate from the registration of other foreigners coming to Israel for other purposes. At that time border cards constituted the major registration instrument. A growing volume of border crossings resulted in considerable delay in processing of the border cards, and inaccuracies of registration triggered a set of upgrading activities by governmental bodies responsible for the registration process.

In November 1998, the Israeli Ministry of Interior created a special Unit for Foreign Workers located in the international airport, with the purpose of upgrading the registration process of foreign workers<sup>2</sup>. Unfortunately, the upgrading effort ended in further deterioration of data quality. Registration of entries were more timely and accurate. A majority of workers paid a visit to the Unit immediately on arrival and went through the registration process there. Otherwise, they could register in the regional offices of the Ministry of Interior. However, the registration on departure was perceived as less crucial due to the lack of legal consequences in case of non-registration. Thus, the registration of foreign workers on departure was incomplete.

Clearly, this impaired the reliability of data on flows (departures), but also- data on stocks. A new inflating error was added to the existing cumulative error. These developments hindered the CBS’ ability to provide reliable statistics of migrant laborers’ departures and end of year estimations of the foreign workers population.

### **The Solution**

The suggested method is based on examination of departure patterns before the crisis, and application of the regularities found to the years of crisis. Existence of departure patterns was identified empirically, by the analysis of the behavior of entry cohorts, and the amendments were made by extrapolation of past behavior into the future.

*Cohort* refers to a group of persons sharing an experience of a particular event during the same period of time<sup>3</sup>. Birth and marriage are the most usual life-events to which the notion of cohort is applied. In this context I introduce a notion of an entry cohort, designating a group of foreign workers (permit holders) entering Israel during the same year.

We followed 1991-1999 entry cohorts in an attempt to identify a pattern suitable for the recovery of faulty data in 2000 and 2001. Table 1 presents patterns of attrition in 1991-2001 as originally registered by the Border Control system.

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<sup>2</sup>For greater details see Staetsky, L. “Israeli Statistics on Foreign Workers: Achievements and Challenges of the Cooperation between the Israeli Central Bureau of Statistics and involved ministries.” Working Paper No. 13, Joint ECE-EUROSTAT Work Session on Migration Statistics, Geneva, 21-23 May, 2001.

<sup>3</sup>For further discussion of cohort analysis see Halli, S. S. and K. V. Rao, Advanced Techniques of Population Analysis (Plenum Press: New York, 1992) and Ryder, N.B. “The Cohort as a Concept in the Study of Social Change,” American Sociological Review, 30 (6), 1965, pp. 843-861.

**Table 1. Entry Cohorts of 1991-2001: Patterns of Attrition (original data)**

Year	Entries	Exits										
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>absolute numbers</b>												
<b>Total</b>	5805	126	200	127	250	51.1	67.6	650	57.0	60.3	357	38.5
<b>1991</b>	20.6	126	6.7	1.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
<b>1992</b>	17.4		133	2.6	1.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0
<b>1993</b>	17.1			9.1	5.8	1.9	0.2	0.1	0.0	0.0	0.0	0.0
<b>1994</b>	43.0				17.8	18.3	6.1	0.5	0.2	0.1	0.0	0.0
<b>1995</b>	78.3					30.6	34.2	9.3	1.0	0.5	0.1	0.1
<b>1996</b>	90.8						27.0	39.7	13.5	2.0	0.4	0.1
<b>1997</b>	64.0							15.4	26.3	16.4	1.2	0.3
<b>1998</b>	64.2								16.0	22.3	13.4	2.3
<b>1999</b>	54.3									19.0	13.4	14.6
<b>2000</b>	53.3										7.2	13.8
<b>2001</b>	77.5											7.2
<b>percents</b>												
<b>1991</b>	1000	<b>61.2</b>	<b>32.5</b>	<b>4.9</b>	<b>1.0</b>	<b>0.5</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>1992</b>	1000		<b>76.4</b>	<b>14.9</b>	<b>6.9</b>	<b>1.1</b>	<b>0.6</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>1993</b>	1000			<b>53.2</b>	<b>33.9</b>	<b>11.1</b>	<b>1.2</b>	<b>0.6</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>1994</b>	1000				<b>41.4</b>	<b>42.6</b>	<b>14.2</b>	<b>1.2</b>	<b>0.5</b>	<b>0.2</b>	<b>0.0</b>	<b>0.0</b>
<b>1995</b>	1000					<b>39.1</b>	<b>43.7</b>	<b>11.9</b>	<b>1.3</b>	<b>0.6</b>	<b>0.1</b>	<b>0.1</b>
<b>1996</b>	1000						<b>29.7</b>	<b>43.7</b>	<b>14.9</b>	<b>2.2</b>	<b>0.4</b>	<b>0.1</b>
<b>1997</b>	1000							<b>24.1</b>	<b>41.1</b>	<b>25.6</b>	<b>1.9</b>	<b>0.5</b>
<b>1998</b>	1000								<b>24.9</b>	<b>34.7</b>	<b>20.9</b>	<b>3.6</b>
<b>1999</b>	1000									<b>35.0</b>	<b>24.7</b>	<b>26.9</b>
<b>2000</b>	1000										<b>13.5</b>	<b>25.9</b>
<b>2001</b>	1000											<b>9.3</b>

The data reveal a gradual increase in the duration of stay of foreign workers during the specified period: 76.4% of those who entered Israel in 1992 departed on the same calendar year and only 29.7% of those who entered Israel in 1996 departed on the same calendar year. Still, the majority of foreign workers departed within two calendar years. However, the proportion leaving during the first two calendar years decreased from 93.7% among those who entered Israel in 1991 to 60% among those who entered in 1999.

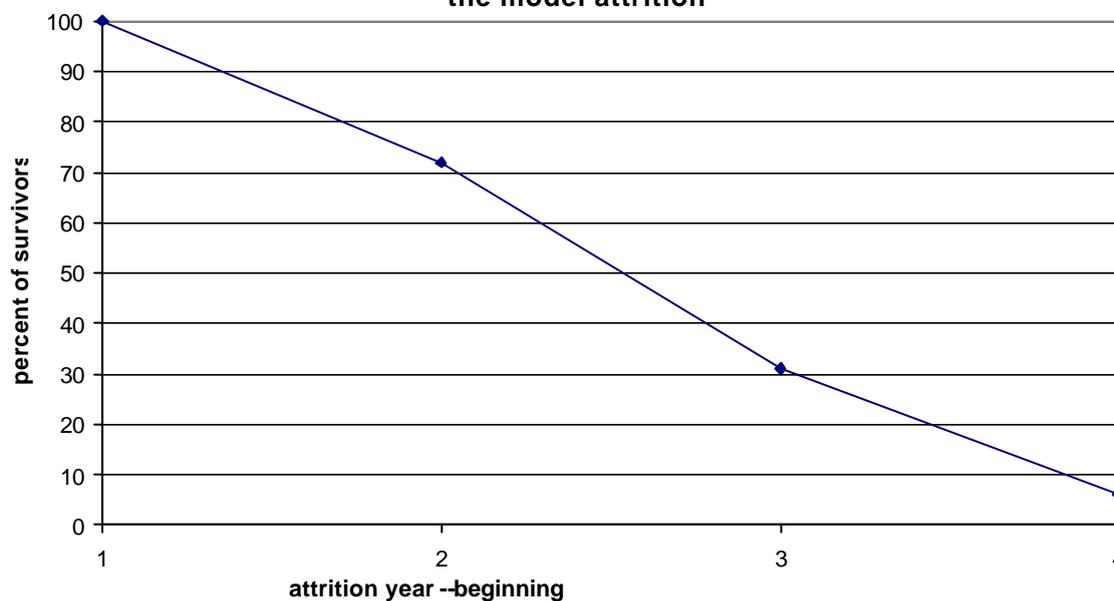
Despite the dynamic nature of cohort behavior, a few regularities can be recognized. First, the proportion of departures (in relation to respective cohort) during the same calendar year never fell below 24%. In addition, since 1994 the proportion of departures during the second calendar year never fell below 35% and the proportion of departures during the third calendar year never fell below 12%. This observation enables us to establish minimal levels of attrition.

In the light of the established minimal levels, periodic “failure” (underregistration) during the years 2000 and 2001 is easily identified. In relation to departure data of 2000, for example, we notice that only 13.5% of the 2000 entry cohort left during the same year (minimum expected –24%), and only 24.7% of the 1999 entry cohort left during their second year (minimum expected-35%). As for the 1998 entry cohort, we can see that 20.9% of them left during 2000--a proportion well above the minimal expectation for the third year of attrition. Still, we suspect that this figure reflects a certain measure of underregistration. This conclusion was reached on the basis of an examination of the overall pattern of cohort behavior. Starting with the 1996 entry cohort, the decrease in the proportion of those leaving during the first calendar year was accompanied by a gradual increase in the proportion of those leaving during the third year. We should expect greater similarity between the attrition pattern of the 1997 and the 1998 entry cohorts: the proportion of those leaving during the third year at about

25% of the initial cohort. Bearing in mind the established minimal levels of attrition, we identify registration flaws in the 2001 data on departures: only 9.3% of the 2001 entry cohort departed in the same calendar year and 25.9% of the 2000 entry cohort left during the second calendar year. As for the 1999 entry cohort, the degree of deviation from the expected pattern is less clear: during the third calendar year 26.9% of the cohort left--again well above the minimal level. We still suspect a certain degree of underregistration, but there is no way to establish a suitable method of correction on the basis of the known attrition pattern.

Recognition of the more or less clear patterns of attrition enables us to recover missing data during the years 2000 and 2001. The recovery method is based on the assumption of continuity in the established patterns. *We rely on average proportions of attrition for the first, second and third year respectively, prior to the crisis, to establish the "ideal" or model attrition.* The average proportion of those leaving during the first calendar year is 28% of an initial cohort (an average of the 1996-1999 entry cohorts), of those leaving during the second calendar year-41% of an initial cohort (an average of the 1995-1998 entry cohorts), of those leaving during the second calendar year-25% (on the basis of the 1997 entry cohort behavior, for reasons explained earlier). Figure 3 presents a "survival" curve, based on the model attrition.

**Figure3. "Survival curve, on the basis o  
the model attrition**



When the original data suggested a higher attrition proportion than the predicted one, the original version was adopted.

d. The "survival" curve shows that the proportion of those who stay after 3 calendar years, according to the model attrition is only about 6% of an initial entry cohort. Table 2 presents a picture of attrition in 1991-2001, with years 2000 and 2001 amended according to the specified principles. Using the expression of John Graunt, "the numbers following are practically near to the truth".

**Table 2. Entry Cohorts of 1991-2001: A Picture of Attrition (amended data)**

Year	Entries	Exits										
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>absolute numbers</b>												
<b>Total</b>	580.5	12.6	20.0	12.7	25.0	51.1	67.6	65.0	57.0	60.3	55.1	61.0
<b>1991</b>	20.6	12.6	6.7	1.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
<b>1992</b>	17.4		13.3	2.6	1.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0
<b>1993</b>	17.1			9.1	5.8	1.9	0.2	0.1	0.0	0.0	0.0	0.0
<b>1994</b>	43.0				17.8	18.3	6.1	0.5	0.2	0.1	0.0	0.0
<b>1995</b>	78.3					30.6	34.2	9.3	1.0	0.5	0.1	0.1
<b>1996</b>	90.8						27.0	39.7	13.5	2.0	0.4	0.1
<b>1997</b>	64.0							15.4	26.3	16.4	1.3	0.3
<b>1998</b>	64.2								16.0	22.3	16.0	2.3
<b>1999</b>	54.3									19.0	22.3	14.6
<b>2000</b>	53.3										15.0	21.9
<b>2001</b>	77.5											21.7
<b>percents</b>												
<b>1991</b>	100.0	<b>61.2</b>	<b>32.5</b>	<b>4.9</b>	<b>1.0</b>	<b>0.5</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>1992</b>	100.0		<b>76.4</b>	<b>14.9</b>	<b>6.9</b>	<b>1.1</b>	<b>0.6</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>1993</b>	100.0			<b>53.2</b>	<b>33.9</b>	<b>11.1</b>	<b>1.2</b>	<b>0.6</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>1994</b>	100.0				<b>41.4</b>	<b>42.6</b>	<b>14.2</b>	<b>1.2</b>	<b>0.5</b>	<b>0.2</b>	<b>0.0</b>	<b>0.0</b>
<b>1995</b>	100.0					<b>39.1</b>	<b>43.7</b>	<b>11.9</b>	<b>1.3</b>	<b>0.6</b>	<b>0.1</b>	<b>0.1</b>
<b>1996</b>	100.0						<b>29.7</b>	<b>43.7</b>	<b>14.9</b>	<b>2.2</b>	<b>0.4</b>	<b>0.1</b>
<b>1997</b>	100.0							<b>24.1</b>	<b>41.1</b>	<b>25.6</b>	<b>2.0</b>	<b>0.5</b>
<b>1998</b>	100.0								<b>24.9</b>	<b>34.7</b>	<b>25.0</b>	<b>3.6</b>
<b>1999</b>	100.0									<b>35.0</b>	<b>41.0</b>	<b>26.9</b>
<b>2000</b>	100.0										<b>28.0</b>	<b>41.0</b>
<b>2001</b>	100.0											<b>28.0</b>

It is to be stressed that the suggested model is based on identification of cohort effects. Therefore, it is a potentially universal tool when there are expressed and persistent cohort effects in migration dynamics. In this context, data quality problems can be considered as period effects to be overcome by thorough analysis of cohort behavior. Furthermore, there is an underlying assumption that period effects do not reflect substantive changes of migration dynamics but can be fully ascribed to imperfections of the registration process. This assumption is supported by comparing the Border Control data to another source—the National Insurance Institute (the NII). Comparison to this source is an important external check on the suggested method.

A number of important properties of **the NII data** should be mentioned in this context:

1. The NII data do not include employee posts of home-care workers and housekeepers insured by the employer.
2. The NII definition of workers from abroad does not apply to workers from Lebanon since the conditions of their employment as regulated by the ES are similar to those of Palestinian workers from Judea, Samaria and Gaza Strip.
3. It is not restricted in coverage to work permit holders and might include certain number of workers without permit who arrived as tourists or whose work permits had expired. To date there are no estimations on the number of workers without permits reported to NII, but it is considered to be small.
4. The NII registration relates to employee posts, rather than actual people. Double registration occurs, for example, when there are two reports of the same worker by two different employers. Again, reliable estimations of multiple registration have not been developed. Yet, according to a conventional view, the phenomenon is numerically negligible.

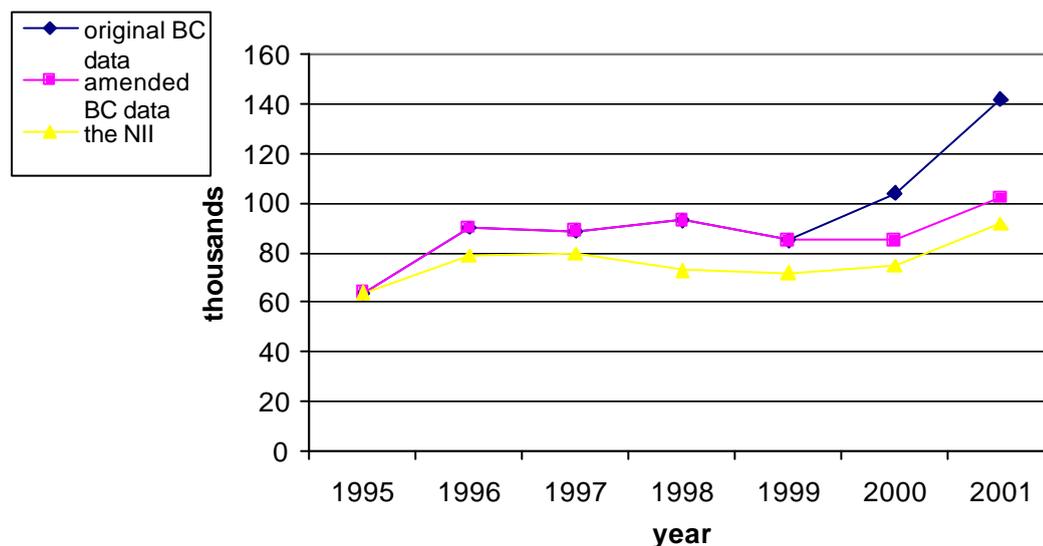
- The NII figures that appear in official CBS publications<sup>4</sup> are calculated as monthly averages.

As for **the BC data**:

- The BC data are universal in nature, i.e. it present a total number of work visa holders. Some of them entered Israel with work visas, granted automatically to work permit holders. Some of them entered Israel with tourist visas and were issued a work visa later in the regional offices of the Ministry of Interior<sup>5</sup>.
- Conventionally, the time-span covered by the data on stocks starts in 1990.
- End of year estimations on the basis of the BC files refer to December 31.

Considering the two basic features of the NII and the BC stock data (exclusion of privately insured home-care workers and universality, respectively), *we should expect the actual number of foreign workers (work visa holders) to be somewhat higher than the number of the reported to the NII*. The two figures can be close if the number of privately insured home-care workers is very low. The number reported to the NII may be higher than the number of work visa holders according to the BC either due to multiple registration or greater representation of workers without permits among those reported to the NII. Both such outcomes are quite unlikely. Figure 4 presents time series of three types of data: the end of year estimations based on the original data from the BC system (with only minor amendments in 1995-1998), the end of year estimations calculated with the help of the model attrition for years 2000 and 2001 and the NII figures (monthly averages).

**Figure 4. End of year estimations of a number of foreign workers : comparison between the NII and the BC data**



Both the *amended BC data* and the *NII data* meet two required dimensions of consistency: consistency of volume and consistency of trend. The slight deviation from the consistency of trend between years 1997 and 1998 can be explained by a significant change in the proportion of foreign workers unreported to the NII. In terms of the consistency of volume, the original BC data seriously deviate from the expected pattern of interaction with the NII data in 2000 and even more so –in 2001.

### Discussion

As was pointed out in the previous sections, migration patterns do not present regularity in a way that mortality and fertility data do. The estimated pattern of departures is contingent on the specific migration context, namely, its economic activities and administrative characteristics. Consequently, a change in one of

<sup>4</sup> “Monthly Bulletin of Statistics” and “Statistical Abstract of Israel”, various years.

<sup>5</sup> Work visa is granted by the Ministry of Interior to holders of work permit issued by the Employment Service. For detailed discussion on changes of visa type see Staetsky, L. “Israeli Statistics on Foreign Workers: Achievements and Challenges of the Cooperation between the Israeli Central Bureau of Statistics and Involved Ministries”, Working Paper No. 13, Joint ECE-EUROSTAT Work Session on Migration Statistics, Geneva, 21-23 May, 2001.

these two domains or both of them might alter the whole migration dynamics and invalidate the suggested model.

There are two possible modes of change:

1. A change resulting in the creation of a new set of cohort regularities. Theoretically, the suggested model can be updated in accordance with the new regularities. However, this can be done only when the new regularities are perfectly known, i.e. when the departure registration process is intact. Under these conditions, there will be no need for a model, since its purpose is “to check and recover” faulty data. It can still be useful for future work, when the imperfections of data emerge again or for analytical examination of migration patterns, as long as the model remains valid. A change of cohort regularities unaccompanied by at least temporary disappearance of data flaws will make the model unsuitable for future utilization.
2. A “chaotic” change resulting in the emergence of alternating period effects, due to irregularities caused by expulsion or policies barring entry or great instability in demand factors of the labor market. This change will completely invalidate cohort analysis.

There is another prerequisite to the suggested method: to be able to identify attrition patterns we need the data on departures to be linked to the data on respective arrivals. The Israeli Border Control system meets the requirement when it comes to the registration of the foreign work permit holders. It is well known that this property of the registration system for foreigners is in no way universal.

There is no real alternative to valid and reliable data coming directly from the administrative sources. However, we need to be prepared to combat deficiencies of data when they emerge. Due to the nature of the underlying phenomenon, migration statistics is in special need for recovery tools.

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