

International Criminal Tribunal
For the Former Yugoslavia

Milutinovic et al.
Case No. IT-05-87 PT

Expert Report of Eric Fruits, Ph.D.

3 February 2008

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1 Executive Summary

Dr. Fruits was retained by counsel for the Accused in the matter of *Milutinovic et al.* (Case No. IT-05-87 PT) to evaluate and opine on the analyses and opinions provided in this matter by Dr. Patrick Ball.

Dr. Ball concludes that Kosovo Albanian deaths and migration exhibit similar “patterns” implying a common cause for both deaths and migration. He also concludes that Kosovo Albanian deaths and migration cannot be explained by KLA and/or NATO activities. He opines that evidence “is consistent” with a hypothesis that Yugoslav forces “conducted a systematic campaign of killings and expulsions.”

All of the data upon which Dr. Ball rely are fundamentally flawed. The data are not sufficient or sufficiently reliable to perform any statistically meaningful analysis. More importantly, the flaws make Dr. Ball’s results unreliable and, in some instances, prejudicial to the Accused.

Rather than rely on well known and widely accepted statistical testing techniques, most of Dr. Ball’s conclusions are based only on ad hoc, informal, and subjective evaluation (e.g., “eyeballing”) of the flawed data.

In the few instances in which Dr. Ball reports a test statistic, the data and approaches underlying the statistics are fundamentally flawed and the statistics are invalid. In some instances the flaws in his data and approaches generate incorrect results that produce conclusions prejudicial to the Accused.

Ultimately, *none* of Dr. Ball's conclusions are supported by any valid statistical analysis or tests.

2 Key findings

2.1 Flaws and errors in Dr. Ball's data

Each of the variables used by Dr. Ball are fundamentally flawed such that his analytical results are unreliable and, in some instances, prejudicial to the Accused.

Migration Dr. Ball's estimates of Kosovo Albanian migration are mismeasured. They do not accurately reflect the flow of individuals across the Morina border. Nor do they accurately reflect individuals' places of origin and travel time. Ultimately Dr. Ball's flawed data and approach produce unusual results that differ substantially from observed migration through the Morina border crossing.

Deaths Dr. Ball unnecessarily inflates the number of Kosovo Albanian deaths. Other independent estimates of Kosovo deaths over the same time period are significantly lower than Dr. Ball's estimates. In his linear regression analysis, Dr. Ball mixes two significantly different estimates of the number of deaths. The result is a statistically unreliable mishmash of estimates from different sources that render his linear regressions meaningless.

KLA activities Dr. Ball relies on two measures of KLA activities: battles and killings. He provides insufficient information to evaluate the accuracy or veracity of the KLA information on which he relies. He indicates that no effort was made to quantify the intensity of individual battles such that isolated skirmishes with no casualties are given the same weight as large scale clashes producing heavy casualties and civilian deaths. He does not explain whether or how he distinguishes deaths resulting from "isolated" attacks and those from a campaign of attacks. These flaws introduce potentially significant measurement error that render his analysis meaningless.

NATO activities Dr. Ball mismeasures the number and location of NATO airstrikes. In particular, NATO press briefings reported airstrikes on several dates that

Dr. Ball's data record no airstrikes. Such fundamental errors are indicative of systematic errors in his data. Differences in linear regression results between Dr. Ball's 2002 Report (P1506) and his 2002 Corrigendum (P1394) indicate that his results are sensitive to even small changes in NATO airstrike data. Thus, to the extent his NATO airstrike data is rife with error, his linear regression results are incorrect and potentially prejudicial to the Accused.

2.2 Flaws and errors in Dr. Ball's analytical approach

Because of fundamental flaws in the data relied upon by Dr. Ball, the data are not sufficient or sufficiently reliable to perform any statistically meaningful analysis. Dr. Ball combines the flawed data with flawed analytical approaches to produce unreliable results that are, in some instances, prejudicial to the Accused.

Contrary to standard statistical practice following the scientific method, most of Dr. Ball's conclusions are supported only by an "eyeballing" of graphs he produced rather than by any type of statistical hypothesis testing. In the few instances in which Dr. Ball performs a statistical test, the data and approaches underlying the tests are fundamentally flawed and the statistics are invalid. Thus, *none* of Dr. Ball's conclusions are supported by any valid statistical hypothesis tests. Worse, in some instances the flaws in his approach ultimately produce conclusions prejudicial to the Accused.

"Patterns" Dr. Ball develops an ad hoc definition of "patterns" to support the conclusions in his report and testimony. He has no baseline against which to compare migration over the relevant time periods. Dr. Ball does not indicate that he considered other reasonable explanations for the migration "patterns" he describes such as unannounced border closings. He provides no statistics or statistical test to support the existence of "patterns" or "similar patterns" of deaths or migration. Instead he presents a subjective opinion based only on "eyeballing" time series graphs he prepared.

"Peaks versus presence" Dr. Ball's "peaks versus presence" approach is not an accepted statistical technique. It does not generate any test statistic or criteria for rejecting a hypothesis. A hypothesis that cannot be rejected is a meaningless hypothesis and a test that cannot be used to reject a hypothesis

is a useless test. Fundamental flaws in the approach produce meaningless, misleading, and potentially prejudicial results. Dr. Ball does not dispute that the presentation of the approach and its results are misleading. He testified that he does not “agree” with the approach he presents (Section 12, note 67, *infra*).

Linear regressions and residuals Most of Dr. Ball’s linear regression results cannot be duplicated. They are unverifiable and cannot be relied upon for evaluating the relationships among deaths and migration and KLA and NATO activities. Dr. Ball omits a key explanatory variable resulting in biased estimates supporting conclusions that prejudice the Accused. He does not consider reasonable alternative—and potentially exculpatory—regression models.

Flaws in Dr. Ball’s linear regression approach are highlighted by the seemingly nonsense results the regressions produce. In particular, the regressions predict a *negative* number of deaths and migration for several observations.

Dr. Ball’s flawed approach and flawed data produce regressions with weak explanatory power. Because of the regressions’ poor fit, they produce a series of residuals that visually appear to be similar to the regressions’ dependent variable (i.e., deaths or migration). Dr. Ball reports no statistics or statistical test of the residuals. Thus, his residual analysis produces no statistically valid conclusions.

3 Qualifications

Eric Fruits, Ph.D. is a professional economist and statistician. In addition to consulting, he is an adjunct professor at Portland State University in the School of Business Administration and the School of Urban Studies and Planning. Exhibit 1 is his curriculum vitae.

Dr. Fruits has a master's and a doctorate in economics from Claremont Graduate University. His graduate-level training included the study of statistics and econometrics (the application of statistical methods to economics issues). He has a bachelor's degree in business economics and public policy from Indiana University.

As a consultant and expert, Dr. Fruits has provided statistical analysis to both plaintiffs and defendants in a variety of legal matters. He has provided expert opinions involving statistics, economics, and finance to United States of America federal and state courts. He has testified in a hearing to determine whether an expert's testimony was grounded in the methods and procedures of science (known in the U.S. as a *Daubert* hearing).

Dr. Fruits has published several peer-reviewed papers. Each of these publications have included statistical and econometric analysis. His article on the formation of cartels was published in the top-tier *Journal of Law and Economics*.

4 Background and assignment

Dr. Fruits was retained by counsel for the Accused in the matter of *Milutinovic et al.* (Case No. IT-05-87 PT) to evaluate and opine on the analyses and opinions provided in this matter by Dr. Patrick Ball.

The (Redacted) Third Amended Joinder Indictment (hereafter, "Indictment") in this matter charges that in the first half of 1999, forces of the Federal Republic of Yugoslavia (hereafter "FRY") and Serbia "in a deliberate and widespread or systematic manner, forcibly expelled and internally displaced hundreds of thousands of Kosovo Albanians from their homes across the entire province of Kosovo" (§25). The Indictment charges the Accused with responsibility for alleged actions taken across Kosovo. However, it alleges specific actions associated with deportation or murder in the following municipalities (§§72, 75):

1. Decani (alleged deportations),

2. Djakovica (alleged deportations and alleged murders),
3. Gnjilane (alleged deportations),
4. Istok (alleged murders),
5. Kacanik (alleged deportations and alleged murders),
6. Mitrovica (alleged deportations),
7. Orahovac (alleged deportations and alleged murders),
8. Pec (alleged deportations),
9. Pristina (alleged deportations),
10. Prizren (alleged deportations),
11. Srbica (alleged deportations and alleged murders),
12. Stimlje (alleged murders),
13. Suva Reke (alleged deportations and alleged murders),
14. Urosevac (alleged deportations),
15. Vucitrn (alleged deportations and alleged murders).

Dr. Ball has provided testimony to the International Criminal Tribunal for the Former Yugoslavia (hereafter "Tribunal") in this matter on 20–21 February 2007. He also provided testimony in the trial of Slobodan Milošević (IT-02-54) on 13–14 March 2002 and 2 May 2003. In addition to his testimony, Dr. Ball has authored or co-authored the following reports and publications related to issues in this matter.

1. *Killings and Refugee Flow in Kosovo March–June 1999: A Report to the International Criminal Tribunal for the Former Yugoslavia*, co-authored with Wendy Betts, Fritz Scheuren, Jana Dudukovich, and Jana Asher, 3 January 2002 (hereafter, "2002 Report (P1506)");
2. A supplemental analysis to the 2002 Report (P1506), 19 February 2002 (hereafter, "2002 Supplement (P1391)");

3. A corrigendum to the 2002 Report (P1506) and 2002 Supplement (P1391), 15 November 2002 (hereafter, "2002 Corrigendum (P1394)");¹
4. *Revisiting "Killings and Migration in Kosovo:" Responses to Additional Data and Analysis*, co-authored with Meghan Lynch and Amelia Hoover, 28 January 2007 (hereafter, "2007 Revision (P2678)"),
5. *Policy or Panic: The Flight of Ethnic Albanians from Kosovo, March–May 1999*, 2000 (hereafter, "Policy/Panic (3D516)"),² and
6. "Statistics and Slobodan: Using Data Analysis and Statistics in the War Crimes Trial of Former President Milosevic," co-authored with Jana Asher, *Chance*, 2002 (hereafter, "Statistics/Slobodan (3D520)").

Dr. Fruits is compensated by the Tribunal for his time and will be reimbursed for any out-of-pocket expenses associated with providing testimony to the Tribunal. His compensation is not dependent on opinions he offers or the outcome of the trial.

In preparing this report Dr. Fruits has relied on his general expertise and knowledge regarding economics and statistics as well as publicly available information and information provided to the Tribunal. The information relied upon is listed in Appendix A. Any of this information as well as summaries or exhibits based on this information may be used at trial.

Dr. Fruits reserves the right to supplement or modify his report and opinions as new or additional information is presented or obtained or analyses are completed, including but not limited to reports provided by the Office of the Prosecutor or its experts.

¹Several items in the 2002 Report (P1506) are revised by the corrections described in the 2002 Corrigendum (P1394). The Office of the Prosecutor (hereafter "Prosecutor") has provided data supporting only the analysis presented in the 2002 Corrigendum (P1394). Data from the 2002 Report (P1506) have not been provided. Throughout this report, unless stated otherwise, it is assumed that data, analysis, figures, and conclusions presented in the 2002 Corrigendum (P1394) correct and/or supersede those presented in the 2002 Report (P1506).

²Citations to Policy/Panic (3D516) are solely to Appendix A of this exhibit which is found on e-court at 3D 01-0272-0306.

5 Summary of conclusions and opinions

The 2002 Report (P1506) lists several of Dr. Ball's conclusions. Over the course of supplements, corrections, and revisions, these conclusions remain unchanged from the original 2002 Report (P1506). Dr. Ball concludes the following:³

1. Kosovo Albanian deaths and migration exhibit "patterns" and the patterns of deaths and the patterns of migration are "similar," implying a common cause for both;
2. Kosovo Albanian deaths and migration cannot be explained by Kosovo Liberation Army (hereafter "KLA") and/or North Atlantic Treaty Organization (hereafter "NATO") activities; therefore
3. Evidence "is consistent" with a hypothesis that FRY forces "conducted a systematic campaign of killings and expulsions."

All of the data upon which Dr. Ball rely are fundamentally flawed. These flaws make his results unreliable and, in some instances, prejudicial to the Accused.

Rather than rely on well known and widely accepted statistical testing techniques, Dr. Ball bases his conclusions only on informal and subjective evaluation of the flawed data. In particular, most of his conclusions are based only on the visual inspection ("eyeballing") of graphs he constructs.

In the few instances in which Dr. Ball reports a test statistic, the data and approach underlying the statistic are fundamentally flawed and the statistic is invalid. In some instances the flaws in his data and approach generate incorrect results that produce conclusions prejudicial to the Accused. Ultimately, *none* of Dr. Ball's conclusions are supported by any valid statistical hypothesis tests.

The bases for Dr. Fruits' conclusions are provided in the remainder of this report.

6 The scientific method and the practice of statistics

Hypothesis testing is a key element of the scientific method. A scientific hypothesis must be testable—there must be an objective method by which the expert can reject or not reject a hypothesis. Statistical analysis is the most widely used technique to

³2002 Report (P1506), p. 1.

test hypotheses. The scientific approach to statistical hypothesis testing includes the following steps:

1. **State the problem.**

Example: Were KLA activities associated with Kosovo Albanian migration out of Kosovo?

2. **Formulate the hypotheses.** A *null* hypothesis is a hypothesis set up to be nullified or refuted in order to support an *alternative* hypothesis. The null hypothesis is presumed true until statistical evidence in the form of a hypothesis test indicates otherwise. The null hypothesis is often the reverse of what the experimenter speculates to be true. This allows the statistical test to refute the null hypothesis.

Example:

- Null: KLA activities *are not* associated with migration,
- Alternative: KLA activities *are* associated with migration.

3. **Design the experiment or survey.** Identify the variables of interest, the sampling method, the methods of controlling measurement error and variability.

Example: Would NATO airstrikes affect the relationship between KLA activities and migration? Are the data sources biased or unreliable?

4. **Collect data.**

5. **Test the hypothesis.** Develop a test statistic. Specify the criteria for rejecting the null hypothesis. Test the hypothesis.

Example:

- Test statistic: linear regression *t*-statistic on KLA activity coefficient.
- Criteria for rejecting the null hypothesis: if $t > 1.65$, then reject the null hypothesis.

6. **Draw conclusions.** Reject or fail to reject the null hypothesis.

Example: If the *t*-statistic on KLA activity coefficient is greater than 1.65, then reject the null hypothesis that KLA activities *are not* associated with migration.

This report demonstrates that most of Dr. Ball's conclusions are supported only by a visual inspection ("eyeballing") of graphs he produced rather than by any type of statistical hypothesis testing.⁴ This report also demonstrates that in the few instances in which Dr. Ball reports a test statistic, the approach underlying the statistic is fundamentally flawed and the test is invalid. Thus, *none* of Dr. Ball's conclusions are supported by any valid statistical hypothesis tests.

7 Flaws in Dr. Ball's migration estimates

Dr. Ball's estimates of migration are mismeasured. They do not accurately reflect the flow of individuals across the Morina border. Nor do they accurately reflect individuals' places of origin and travel time.

Dr. Ball's "refugee flow" data are his estimates of (1) the *number* of individuals leaving a given municipality; (2) the *municipality* from which they left; and (3) the *date* on which they left the municipality.⁵

This section describes several fundamental flaws in Dr. Ball's migration estimates. These include inconsistencies in Dr. Ball's estimates of migration, flaws in his municipality-of-origin estimates, and flaws in his date-of-migration estimates. Ultimately Dr. Ball's flawed approach produces unlikely results that differ substantially from observed migration through the Morina border crossing.

7.1 Inconsistencies in estimates of total migration

Dr. Ball's summary of Albanian border data estimates that 276,500 individuals crossed the border between 28 March and 28 May.⁶ These are the data used in Dr. Ball's "peaks versus presence" analysis. After "supplementing" the Morina border counts, Dr. Ball's estimate of the number of individuals who crossed the

⁴See, for example, Milutinovic et al. (IT-05-87 PT), 10233:22–24: "It [2007 Revision (P2678), Figure 2, p. 7] is a bit of a mess, seeing seven lines on a single graph, but to my eye, they show precisely the same thing with seven independent lines."

⁵Policy/Panic (3D516), p. 35: "This project is based on records maintained by the Albanian officials at the Morina border crossing from Kosovo. These data are the major component of the statistics computed to estimate the population parameter B_{vd} , the number of people crossing the border on day d from city or village of origin v ." See note 2, *supra*.

⁶Policy/Panic (3D516), p. 36: "The number of people registered in the border records is 276,461 (see Eq 3)." See note 2, *supra*.

border increases almost 50 percent to 404,000.⁷ Yet, for purposes of performing his linear regression analysis, the number drops to 352,700.⁸ In contrast, NATO estimates total migration of 723,800 between 29 March and 20 May, of which 433,300 (60 percent) migrated to Albania.⁹

7.2 Flaws in municipality-of-origin estimates

Dr. Ball's migration estimates are based on records that were maintained by the Albanian officials at the Morina border crossing. In some cases, the number of individuals crossing the border and their municipality of origin were recorded by Albanian border officials. In most cases, however, the municipality of origin is unknown and Dr. Ball estimates (or "imputes") the municipality of origin using surveys of individuals conducted after they left Kosovo.^{10,11}

From the border records and surveys, Dr. Ball constructs distributions of municipalities of origin. These constructed distributions are then applied to the actual distribution of those crossing at the Morina border. In this way Dr. Ball "imputes" (i.e., estimates) the municipalities from which individuals migrated.

Dr. Ball relied on a small number of surveys and many surveys were conducted a month or more after the respondent crossed the border.^{12,13} He indicates that

⁷Policy/Panic (3D516), p. 39: "The total estimated number of people who crossed the border between 24 March and 28 May is approximately 404,000 (see Eq. 4), where d is summed over the period 28 March–28 May." See note 2, *supra*.

⁸Calculated from documents 0324-8866–0324-8867 (also available at http://shr.aaas.org/kosovo/killing/dtk2_oth.csv), between 20 March and 27 May, rounded to nearest hundred.

⁹North Atlantic Treaty Organization, Total refugee flow as at 20 May 99, URL <http://www.nato.int/pictures/1999/990520/b990520j.jpg>, retrieved 21 February 2007.

¹⁰Policy/Panic (3D516), p. 40: "Of the original 276,000 people registered in the border data, approximately 69% are identified by their home village. When the overflow from the UNHCR and EMG counts are added, only about 49% of the people estimated to have crossed at Morina came from known home villages." See note 2, *supra*.

¹¹Policy/Panic (3D516), p. 35: "To impute the two components of \hat{b}_{vd} [the estimate of the number crossing the border from a given village on a given day] for which some data are missing, data collected from refugees sampled from camps in Albania and Macedonia are used to allocate counts of people with missing origin data to municipalities." See note 2, *supra*.

¹²A sample is too small if it does not have a sufficient number of observations to control for the variation within a specific jurisdiction or time period. Thus, even a seemingly large survey may be too small if the observations insufficiently control for variation. Dr. Ball's data set has over 1,000 municipality-date variables (29 municipalities and 35 2-day periods for migration and 44 2-day periods for deaths).

¹³Dr. Ball relied on results from 2,078 surveys conducted by Physicians for Human Rights and the Institute for Policy and Legal Studies. The PHR surveys were conducted April–May 1999. The IPLS

there may be significant systematic differences between individuals whose municipalities of origin were recorded at the border and those whose municipalities he “imputed.”¹⁴ For example, if one were to accept Dr. Ball’s estimates of the number crossing the Morina border and NATO’s estimates of the total number who migrated to Albania, then 93 percent of those who migrated to Albania did so through the Morina border. Only 7 percent of the survey respondents, however, are recorded on the registry maintained by the Albanian officials at the Morina border crossing.¹⁵ Somehow—by accident or by design—the surveys on which Dr. Ball rely seem to have systematically excluded those whose names were recorded at the Morina border crossing. Dr. Ball does not indicate that he accounts for any sample selection biases that may arise from such systematic differences. Because of these fundamental flaws, no confidence should be placed in the accuracy of Dr. Ball’s municipality-of-origin estimates.

7.3 Flaws in date-of-migration estimates

Dr. Ball estimates the date on which individuals left a municipality by using data collected from interviews conducted of Kosovo Albanians in camps in Albania.¹⁶ Interviews were conducted by Human Rights Watch, Physicians for Human Rights, and the Institute for Policy and Legal Studies.¹⁷

From the surveys, Dr. Ball constructs a distribution of transit times—the amount of time he estimates it took to travel from home to the Morina border. This constructed distribution is then applied to the actual distribution of those crossing at the Morina border. In this way, Dr. Ball imputes the dates that individuals left their homes.

surveys were conducted May–June 1999. See Policy/Panic (3D516), pp. 37, 40. See note 2, *supra*.

¹⁴Policy/Panic (3D516), p. 40: “For example, the border guards told this project that people in cars were always registered, but that people on foot were sometimes missed. If people in cars originated in locations systematically different from the people on foot, then the distribution of people across origin villages b_{vd}^R could be different from the distribution in b_{vd}^A .” See note 2, *supra*.

¹⁵Policy/Panic (3D516), p. 40. See note 2, *supra*.

¹⁶Policy/Panic (3D516), p. 35: “The transformation of the estimated number of people exiting Kosovo, \hat{b}_{vd} , into an estimated number of people departing from their homes, denoted \hat{g}_{vd} , is described in the Section A3.” See note 2, *supra*.

¹⁷Policy/Panic (3D516), p. 41: “A sample list was composed of interviews conducted by HRW, PHR, and IPLS among Kosovar Albanian refugees in camps in Albania. Each of the three lists was matched to the other two and duplicates dropped to create a single, unified dataset of 753 interviews.” See note 2, *supra*.

Dr. Ball relied on a small number of surveys.¹⁸ Many surveys were conducted a month or more after the respondent crossed the border.¹⁹ As with surveys used to estimate municipality of origin, there may be significant systematic differences between those crossing the border and those selected and surveyed by human rights groups. Indeed, Dr. Ball notes that Human Rights Watch was seeking information on human rights violations.²⁰ As such, HRW's approach would be biased toward surveying individuals from municipalities with higher numbers of alleged violations. Dr. Ball does not indicate that he accounts for any sample selection biases that may arise from such systematic differences. Thus, no confidence should be placed in the accuracy of the survey data supporting Dr. Ball's date-of-migration estimates or the estimates themselves.

7.4 Dr. Ball's approach produces unlikely results

Dr. Ball's approach produces a set of detailed migration data. For any 2-day period, his approach provides an estimate of the number of individuals leaving any given municipality or village. The precision however is a façade for fundamentally flawed and unrealistic results. It is likely that all of Dr. Ball's migration estimates are fundamentally flawed. Observations from two municipalities in particular demonstrate the severity of Dr. Ball's flaws and the unreasonableness of his migration estimates.

Leposavic Exhibit 4 shows that no one from Leposavic was recorded at the Morina border crossing. Dr. Ball however, concludes that 514 individuals left Leposavic between 24 March and 9 April and crossed into Albania via the Morina border crossing. Indeed, he precisely estimates how many individuals left during each 2-day period.

The Indictment does not allege any deportation from Leposavic. It is the northernmost municipality in Kosovo and is surrounded on three sides by Serbia (Exhibit 2). It has the smallest ethnic Albanian population in all of Kosovo, 6 percent (Exhibit 3). These factors as well as the fact that no one from the municipality was

¹⁸Note 17, *supra*.

¹⁹The HRW surveys were conducted March–June 1999. The PHR surveys were conducted April–May 1999. The IPLS surveys were conducted May–June 1999. See Policy/Panic (3D516), p. 37. See note 2, *supra*.

²⁰Policy/Panic (3D516), p. 37. See note 2, *supra*.

recorded crossing at the Morina border, indicate that it is unlikely that Dr. Ball's estimates accurately measure migration from Kosovo.

Novo Brdo Exhibit 5 shows that no one from Novo Brdo was recorded in the Morina border crossing data. Dr. Ball however, concludes that 36 individuals left Novo Brdo between 24 March and 15 April. Indeed, he precisely estimates how many individuals left during each 2-day period.

The Indictment does not allege any deportation from Novo Brdo. It is an eastern municipality with a significant Serb majority.²¹ These factors as well as the fact that no one from the municipality was recorded crossing at the Morina border, indicate that it is unlikely that Dr. Ball's estimates accurately measure migration from Kosovo.

Other municipalities Exhibit 6 summarizes the differences between the Morina border crossing records and Dr. Ball's estimates. In total, Dr. Ball's estimate of the number crossing at the Morina border is more than 140,000 (20 percent) larger than the number in the records.

Observations from individual municipalities in the exhibit demonstrate the severity of Dr. Ball's flaws and the unreasonableness of his migration estimates. For example, Dr. Ball's estimates of the number of individuals originating from Istok is 2.5 times greater than the number in the Morina border crossing records. In the border records, those from Istok comprised 2.6 percent of the total whose municipality of origin was recorded. Dr. Ball estimates that individuals originating from Istok comprise 3.8 percent of the total. This represents almost a 50 percent increase in the share of individuals originating from Istok. Thus, Dr. Ball's flawed approach (1) increases the estimated number crossing the Morina border and (2) shifts the shares of migration by municipality.

Dr. Ball's estimate of the number of individuals originating from Gnjilane is 6.7 times greater than the number in the Morina border crossing records. His estimate of the number of individuals originating from Pristina is 4.2 times greater than the number in the Morina border crossing records. Dr. Ball's estimate of the number of individuals originating from Glogovac is 3.5 times greater than the

²¹ Although Exhibit 3 indicates that Novo Brdo is almost 60 percent Serb, Exhibit 2 and statements by counsel suggest a larger Serb majority (Milutinovic et al. (IT-05-87 PT), 10378:9–21).

number in the Morina border crossing records.

Dr. Ball's estimate of the share of individuals originating from Gnjilane is 4.5 times greater than the share in the Morina border crossing records. His estimate of the share of individuals originating from Pristina is 2.5 times greater than the share in the Morina border crossing records. Dr. Ball's estimate of the share of individuals originating from Glogovac is 2.0 times greater than the share in the Morina border crossing records.

8 Flaws in Dr. Ball's estimates of the number of deaths

Dr. Ball unnecessarily inflates the number of Kosovo Albanian deaths. Indeed, other independent estimates of Kosovo deaths over the same time period are significantly lower than Dr. Ball's estimates.

8.1 Dr. Ball unnecessarily inflates the estimated number of deaths

Dr. Ball develops a list of "documented" deaths.²² The list is developed from interviews conducted by the American Bar Association/Central and East European Law Initiative, Human Rights Watch, the Organization for Security and Cooperation in Europe, and exhumation reports produced on behalf of the Tribunal.²³ The list grows from almost 4,200 deaths in which the municipality and date of death can be identified to 4,400 "recorded" deaths in which some dates of death are imputed by Dr. Ball. Dr. Ball then uses an estimation approach to inflate the number to 10,356 Kosovo Albanian deaths.

Dr. Ball's sources provide 4,196 deaths in which the municipality and date of death can be identified.²⁴ Approximately 200 records have no date of death information. For these records, Dr. Ball assigns three different dates of death at random,

²²2002 Report (P1506), p. 33; 0324-8872-0324-9015 (also available at <http://shr.aaas.org/kosovo/killing/md.pub.csv>).

²³2002 Report (P1506), p. 17.

²⁴2002 Report (P1506), p. 30. Dr. Ball provides no explanation for the differences in the numbers provided in the 2002 Report (P1506) and in the data (0324-8872-0324-9015, also available at <http://shr.aaas.org/kosovo/killing/md.pub.csv>).

based on the dates of the geographically closest deaths, using an imputation procedure he calls “hot decking.” Each of the three randomly assigned dates are assigned a weight of 0.33.²⁵

Imputation procedures may be useful in some circumstances, especially those in which the imputation may control for biases associated with sample or self selection. Dr. Ball’s “hot decking” procedure, however, shuffles approximately 200 records with no date of death information into the deck of other observations. The result increases the number of deaths in the data set, but does nothing to improve the accuracy of the date of death information. Indeed, his procedure has the effect of dampening the natural variation in the series, thereby reducing the information provided.²⁶ Thus Dr. Ball unnecessarily inflates the number of “recorded” deaths.

After creating his list of 4,400 “recorded” deaths, Dr. Ball uses a multiple systems estimation approach to inflate the number of Kosovo Albanian deaths to 10,356.²⁷ Dr. Ball never uses this inflated number, however, to support any of his conclusions regarding the relationships among deaths, KLA activities, and NATO airstrikes. Indeed, Dr. Ball indicates that the inflated number is irrelevant to his analysis.²⁸

8.2 Dr. Ball’s inflated estimates are inconsistent with other estimates of Kosovo deaths

Between 20 March and 23 June 1999, the 2002 Report (P1506) estimates 10,356 Kosovo Albanian deaths with a 95 percent confidence interval of 9,002–12,122.²⁹ Dr. Ball suggests that this inflated estimate is consistent with estimates presented

²⁵On several dates in several municipalities, no deaths are identified yet Dr. Ball’s “hot decking” assigns one or more deaths to these date/municipality observations. In effect, he asserts a death occurred on a given date in a given municipality when, in fact, it is possible or likely that no death occurred at all. For example, no one was reported killed in Vitina on 4 April. Yet, Dr. Ball assigns 4 deaths to that date/municipality observation with a weight of 0.33 each, for a “recorded” number of deaths of 1.32.

²⁶2002 Report (P1506), p. 30, note 45.

²⁷2002 Report (P1506), Appendix 2.

²⁸Milutinovic et al. (IT-05-87 PT), 10319:9–11: “This said, as we discussed in the previous line of questioning, whether the number is 10,356 or 4,200 turns out to make relatively little difference to the analysis being given in this report. Again, referring you to the graph, figure 1, appendix 2, the unadjusted graph with the raw data, we find the same pattern. So we can debate the validity of the statistical estimate of the total, but the underlying argument is the same whether or not you make the estimate or not.”

²⁹2002 Report (P1506), p. 45 and Figure 13; 2002 Corrigendum (P1394), Figure 13.

in three other studies.³⁰ This suggestion is incorrect and misleading. Two of the cited studies estimate significantly fewer deaths over the relevant time period than Dr. Ball's inflated estimate. Dr. Ball himself developed the analysis approach and computed the estimates in the third study. It is, therefore, unsurprising that the results from the third study are virtually identical to the inflated estimates provided in the 2002 Report (P1506) and 2002 Corrigendum (P1394).

Spiegel and Salama Spiegel and Salama estimate 12,000 Kosovo Albanian deaths from war-related trauma during the 17 month period from February 1998 to June 1999.³¹ Thus, Spiegel and Salama's data span a time period much earlier and much longer than the time period specified in the Indictment. Approximately 60 percent of Spiegel and Salama's estimated deaths occurred March–June 1999.³² As such, Spiegel and Salama estimate only 7,200 Kosovo Albanian deaths from war-related trauma—30 percent fewer than Dr. Ball's inflated estimate. Indeed, Spiegel and Salama's estimate would be outside of Dr. Ball's 95 percent confidence interval, indicating that their estimate is statistically significantly lower than Dr. Ball's inflated estimate.

PHR Physicians for Human Rights surveyed a random sample of 1,209 Kosovo refugees in 31 refugee camps and collective centers in Albania and Macedonia between 19 April and 3 May 1999.³³ The study did not report the number of deaths by date or by municipality. Thus, it is impossible to make any comparison with Dr. Ball's inflated estimate.

PHR's estimation approach is fundamentally flawed. The authors find approximately one-half of 1 percent of survey respondents "reported" a death of a household member (Table 4, p. 45). The authors then apply the percentage to the entire population of Kosovo Albanians to come up with a total number of deaths. Such simple arithmetic is based on the unrealistic assumption that circumstances and experiences of Kosovo Albanians who left Kosovo and were surveyed by PHR were no different from those who remained.

³⁰2002 Report (P1506), p 6.

³¹Spiegel, P. B. and Salama, P., "War and mortality in Kosovo, 1998–99: An epidemiological testimony," *The Lancet*, 2000, 355:2204–2209 at 2206.

³²Calculation based on Spiegel and Salama, Figure 2, p. 2207.

³³Physicians for Human Rights, *War Crimes in Kosovo: A Population-Based Assessment of Human Rights Violations Against Kosovar Albanians*, 1999.

The PHR study spans a time period much earlier and much longer than specified in the Indictment. It covers the dates 1 April 1998 through 3 May 1999.³⁴ Thus, all of the estimates provided by the PHR study necessarily overstate the number of deaths associated with the period covered by the Indictment. Assuming the distribution by date of death estimated by Spiegel and Salama can be applied to other studies, then slightly less than 60 percent of the Kosovo Albanian deaths estimated by PHR would have occurred in March–May 1999.³⁵ As such, the PHR study would estimate no more than 5,600 “killings”—nearly half as many as Dr. Ball’s inflated estimate. Indeed, PHR’s estimate would be outside of Dr. Ball’s 95 percent confidence interval, indicating that its estimate is statistically significantly lower than Dr. Ball’s inflated estimate.

AAAS/ABA/CEELI The American Association for the Advancement of Science and American Bar Association Central and East European Law Initiative study produced estimates that are virtually identical to the inflated estimates in the 2002 Report (P1506).³⁶ The AAAS/ABA/CEELI study estimates 10,538 Kosovo Albanian deaths, the 2002 Report (P1506) estimates 10,356 Kosovo Albanian deaths.³⁷ These virtually identical results are no coincidence. As with the 2002 Report (P1506), the data analyses in the AAAS/ABA/CEELI study were conducted by Dr. Ball. Indeed, he conceptualized the analysis approach, designed the list matching system, and computed the estimates and their standard errors.³⁸ Thus, it would be misleading to characterize the AAAS/ABA/CEELI estimates as independent confirmation of the estimated number of Kosovo Albanian deaths provided by the 2002 Report (P1506).

³⁴PHR, p. 43: “Furthermore, the rate of killing reported among household members in our study (0.515% between April 1, 1998 and May 3 1999) is similar to that reported by Medecins sans Frontieres (0.573% between February 28 1998 and April 27 1999) over a similar period of time.”

³⁵Calculation based on Spiegel and Salama, Figure 2, p. 2207.

³⁶American Association for the Advancement of Science and American Bar Association Central and East European Law Initiative, *Political Killings in Kosova/Kosovo, March–June 1999: A Cooperative Report by the Central and East European Law Initiative of the American Bar Association and the Science and Human Rights Program of the American Association for the Advancement of Science*, 2000.

³⁷AAAS/ABA/CEELI, p. 9.

³⁸AAAS/ABA/CEELI, p. xii: “Data analyses were conducted by Patrick Ball, from AAAS, and Sandra Eyster. Dr. Ball conceptualized the analysis techniques, designed the list matching system and computed the estimates and their standard errors.”

9 Flaws in Dr. Ball's KLA data

Dr. Ball relies on two measures of KLA activities: (1) KLA battles, and (2) KLA killings. He defines KLA *battles* as “the number of reported battles between the KLA and Yugoslav forces occurring in each municipality over time.”³⁹ An alternative definition he provides is “the number of reported KLA exchanges of fire with Serb authorities.”⁴⁰ The 2002 Report (P1506) provides the following description of KLA *killings*: “Isolated KLA attacks that resulted in the injury, disappearance, or deaths of ethnic Serbs were also tabulated by the number of casualties. These are counts of reported Serb casualties, not estimates.”⁴¹

The 2002 Report (P1506) indicates that the KLA information was provided by the Tribunal. Dr. Ball does not specify the sources or how the information was converted to quantitative data. Thus, it is impossible to evaluate the accuracy or veracity of the KLA information on which Dr. Ball relies.

Dr. Ball's description of the data point to several serious flaws in his KLA data. The 2002 Report (P1506) indicates that no effort was made to quantify the intensity of individual battles.⁴² Apparently, isolated skirmishes with small arms fire and no casualties are given the same weight as large scale clashes involving armored units, heavy casualties, and civilian deaths. Such distinctions may be critical in quantifying the relationships between KLA-FRY engagements and Kosovo Albanian deaths and migration.

Dr. Ball does not explain what is meant by “isolated KLA attacks.” He does not explain whether or how he distinguishes “isolated” attacks from a campaign of attacks. His description suggests an ad hoc and subjective approach that likely produces unreliable data.

³⁹2002 Report (P1506), p. 11.

⁴⁰0324-8869 and 0324-8870.

⁴¹2002 Report (P1506), p. 11. Contrary to the accepted definition of *casualties*, Dr. Ball apparently uses the term synonymously with *deaths*. See *Webster's New Universal Unabridged Dictionary*, 1989, entry for *casualty*: “a member of the armed forces lost to his unit through death, wounds, sickness, capture, or because his whereabouts or condition cannot be determined.”

⁴²2002 Report (P1506), p. 11.

10 Flaws in Dr. Ball's NATO airstrike data

Dr. Ball mismeasures the number and location of NATO airstrikes. This mismeasurement is highlighted by identifying several dates in which NATO press briefings report airstrikes occurring but Dr. Ball's data record none. While the highlights presented in this report are confined to a subset of Dr. Ball's NATO airstrike data, they are indicative of systematic errors in his data set.

Dr. Ball's "peaks versus presence" approach and his linear regressions use an estimate of NATO airstrikes that he constructed. He considers the number of NATO airstrikes, as reported by FRY government sources. He does not quantify the severity of each airstrike and reports of different airstrikes are counted separately.⁴³

Dr. Ball testified that he made a perfunctory and unsuccessful effort to obtain information on NATO airstrikes from the United States Department of Defence.⁴⁴ He does not indicate whether he attempted to obtain information from NATO.

The flaws in Dr. Ball's NATO airstrike data are highlighted by several obvious errors. Dr. Ball's data contain several gaps: dates in which no NATO airstrikes are reported.⁴⁵ In both the "peaks versus presence" approach and the linear regressions, these gaps are treated as zeroes—as if no airstrikes occurred that day. In contrast, Exhibit 8 shows that NATO reported conducting airstrikes on 6 dates in which Dr. Ball's data record none.⁴⁶ These obvious errors in the most easily verifiable subset of Dr. Ball's data suggest that his entire data set does not accurately reflect the true number and location of NATO airstrikes.

The 2002 Corrigendum (P1394) corrects the 2002 Report (P1506) by changing NATO airstrike data. Dr. Ball testified that the data is from "open sources and from other material published in Belgrade and elsewhere maybe."⁴⁷ He does not specify the sources for the changed data.

Dr. Ball describes the corrections in the 2002 Corrigendum (P1394) as "small."⁴⁸

⁴³2002 Report (P1506), p. 12.

⁴⁴Milutinovic et al. (IT-05-87 PT), 10282:9–10283:10.

⁴⁵See 0324-9511–0324-9528 (also available at http://shr.aaas.org/kosovo/otherdata/nato_bombing_data.csv).

⁴⁶Information is publicly available from NATO's website (<http://www.nato.int/kosovo/all-frce.htm>). The Internet Archive indicates that this information was publicly available as early as 2 March 2000 (http://web.archive.org/web/*/http://www.nato.int/kosovo/all-frce.htm, retrieved 5 April 2007).

⁴⁷Milošević (P2690), 19948:1–7.

⁴⁸2002 Corrigendum (P1394), p. 2.

These “small” corrections, however, seem to produce substantial differences between the linear regression results reported in the 2002 Report (P1506) and the 2002 Corrigendum (P1394). For example, the 2002 Report (P1506) finds no significant statistical relationship between NATO airstrikes and deaths or migration. The 2002 Corrigendum (P1394), in contrast, finds a statistically significant *negative* relationship between NATO airstrikes and deaths.⁴⁹ These differences indicate that Dr. Ball’s results are sensitive to small changes in NATO airstrike data. Without accurate NATO airstrike information, it is impossible for Dr. Ball’s analysis to provide any reliable conclusions regarding the relationship among NATO airstrikes and deaths and migration.

11 Flaws in Dr. Ball’s findings of “patterns” of deaths and migration

Dr. Ball concludes that deaths and migration exhibit “patterns” or “phases” distinguished by several “low points” preceded and followed by “distinct peaks.” He claims that this conclusion is “the key component” of his findings. He asserts that statistically, it is implausible that such “patterns” would result from ad hoc decision making or random external causes.⁵⁰

Dr. Ball also concludes that death and refugee flows exhibit “similar patterns.” He asserts that such seemingly similar “patterns” suggest a common, systematic cause of which the patterns are results.⁵¹

Dr. Ball develops an ad hoc definition of “patterns” to support the conclusions in his report and testimony. He has no baseline against which to compare migration over the relevant time periods. He provides no statistics or statistical test to support the existence of “patterns” or “similar patterns” of deaths or migration. Instead he presents a subjective opinion based only on “eyeballing” time series graphs he prepared.

⁴⁹2002 Corrigendum (P1394), p. 2.

⁵⁰2002 Report (P1506), pp. 4–5.

⁵¹2002 Report (P1506), p. 4.

11.1 Dr. Ball reports no baseline against which to compare migration over the relevant time period

Dr. Ball's border crossing records cover 28 March through 28 May 1999. He reports no information on the number of individuals who cross the border before or after that period. Such before-and-after data would provide a *baseline* against which border crossing information for the relevant time period of interest can be compared. Without such information, it is impossible to use Dr. Ball's data to evaluate the extent to which the levels of border crossings over the time period of interest differ from "normal" or baseline levels of border crossings.

11.2 Dr. Ball does not demonstrate statistically the existence of "patterns" of deaths or "patterns" of migration

Dr. Ball asserts that his discovery of "patterns" of deaths and migration is the key component of his findings.⁵² He also concludes that deaths and migration each exhibited "regular" patterns.⁵³ He further concludes that existence of these "patterns" indicate a "common cause" for the patterns.⁵⁴

The 2002 Report (P1506) defines a *pattern* as "a series of distinctive, clearly non-random movements, trending upward and downward."⁵⁵ What Dr. Ball describes as a pattern has no meaning in the practice of statistics. He does not explain what is meant by "distinctive" or "clearly non-random." Thus, Dr. Ball's ad hoc definition is uninformative and meaningless. Worse, the ad hoc definition seems to be designed to support, rather than to test, his conclusions.

Dr. Ball's conclusions about the "patterns" of deaths and migration are supported only by his interpretation of a visual inspection of 2002 Report (P1506)

⁵²2002 Report (P1506), p. 4: "The structure of the patterns in both refugee flow and killings over the time period in question is the key component for the findings of the present study."

⁵³2002 Report (P1506), p. 3: "Killings and refugee flow occurred in a regular pattern characterized by three phases. In each phase, a high volume of killing and refugee flow was followed by a much lower level of killing and refugee flow."

⁵⁴2002 Report (P1506), p. 5: "The mass exodus of Kosovar Albanians on this scale and in this pattern could only have been driven by a common cause."

2002 Report (P1506), p. 5: "As with refugee flow, we conclude that the statistical patterns of killings indicate that they resulted from a common cause."

⁵⁵2002 Report (P1506), p. 4.

Figure 1 and 2002 Corrigendum (P1394) Figures 2 and 4–7.⁵⁶ Visual inspection of a data series is entirely subjective. Dr. Ball can “eyeball” the graphs and find patterns that support his conclusions while someone else can “eyeball” the data and find patterns contrary to Dr. Ball’s conclusions. Statistical analysis of the two series could have provided an objective and verifiable test of Dr. Ball’s hypothesis. He, however, reported no statistics or statistical tests.

11.3 Dr. Ball does not demonstrate statistically that deaths and migration exhibit “similar patterns”

In addition to his conclusion that deaths and migration exhibit “patterns,” Dr. Ball concludes that deaths and migration exhibit “similar patterns” over time and place. He further concludes that the similarity of these “patterns” indicate a “common cause” for the patterns.⁵⁷

The similarity of the “patterns” may not be coincidental. As noted in Section 7, migration data (the number leaving their homes over time and location) was constructed by Dr. Ball. Applying survey results to border crossing records, Dr. Ball imputed the number of individuals leaving and the dates they left a particular municipality. In so doing, Dr. Ball produced the “patterns” of migration that he concludes are similar to the “patterns” of deaths.

Dr. Ball’s conclusions about the “patterns” of deaths and migration are supported only by his interpretation of a visual inspection (“eyeballing”) of the data series. Yet, he concludes that variations in deaths and migration are “correlated.”⁵⁸ Statistical analysis of the two series would have provided an objective and verifiable test of Dr. Ball’s hypothesis. However, he does not report any statistical tests or correlation statistics.

⁵⁶See, for example, 2002 Report (P1506), p. 5: “The extreme fluctuation [in Figure 1] between high and low points constitutes the pattern in the refugee flow.”

⁵⁷2002 Report (P1506), p. 4: “The correlated, nearly simultaneous variations in the social phenomena being measured (killings and refugee flow) in time and location strongly suggest a common, systematic cause of which the patterns are results.”

⁵⁸Note 57, *supra*.

11.4 Morina border closings coincide with the beginning of each of Dr. Ball's "phases"

Dr. Ball divides data into three phases. He contends that the essential characteristic of the phase structure is the presence of low points in the number of refugees leaving their homes. He contends that these low points are significant because they do not last for extended periods of time.⁵⁹ Dr. Ball argues that migration that resulted from dispersed, decentralized causes would not show "distinct separations" between dates with high migration and dates with low migration. Instead, he argues, there would be a more uniform distribution of numbers over time.⁶⁰

Dr. Ball does not indicate that he considered other reasonable explanations for the migration "patterns" he describes. Exhibit 9 suggests one reasonable alternative explanation. It shows that each of the low points in the number of individuals and groups registered at the Morina border coincide with the border being closed.⁶¹ When the border closes, border crossings approach zero. When the border reopens, the number of crossings increase. When the border was closed, it was closed for a relatively short period (1–3 days, with the exception of 13–19 May when the border closing coincided with NATO airstrikes near the border and the closing of railway stations).

11.4.1 The Morina border crossing was closed during the Orthodox Easter unilateral ceasefire

Dr. Ball indicates that Kosovo Albanian deaths and migration experienced an "extreme decline" and "fell drastically" during the Orthodox Easter unilateral ceasefire declared by FRY authorities. He concludes that the declines associated with this single event show a circumstantial link between FRY forces activities and deaths

⁵⁹2002 Report (P1506), p. 4.

⁶⁰2002 Report (P1506), p. 5.

⁶¹See, for example, BBC, "Border shut on refugee tide," 29 March 1999, <http://news.bbc.co.uk/1/hi/world/europe/306703.stm>, retrieved 27 September 2006; FDCH Political Transcripts, "James Rubin holds State Department news briefing," 7 April 1999; Lippman, T. W., "NATO expands fleet of aircraft, refugees reappear at Kosovo borders," *Washington Post*, 11 April 1999; Canadian Press, "Serbs turning back refugees, TV transmitter among NATO targets," 19 April 1999; Eddy, M., "Ethnic Albanians stuck at railway stations, refugees say," *Associated Press Worldstream*, 13 May 1999; and Myre, G., "Kosovo refugees pour into Albania," *Associated Press Online*, 21 May 1999.

and migration.⁶² Exhibit 9 shows that the Morina border crossing was closed 7–9 April. Indeed, no one was recorded crossing the border on 8–9 April.

Dr. Ball erroneously suggests that a decline in the number of deaths during 6–7 April matches the “pattern” of migration “precisely.”⁶³ Exhibit 10 provides the recorded number of deaths over time. Contrary to Dr. Ball’s suggestion, it does not provide any obvious indication of an “extreme decline” in the number of deaths during 6–7 April. Indeed, contrary to Dr. Ball’s conclusion, the following table indicates that the number of recorded deaths were *higher* on 6–7 April than in the 2 days prior or 2 days following.⁶⁴

Date	Recorded Deaths
4–5 April	84
6–7 April	138
8–9 April	109

12 Dr. Ball’s “peaks versus presence” approach is not an accepted statistical technique

Throughout his reports Dr. Ball presents analysis from an approach he concocts and calls “peaks versus presence.”⁶⁵ The analysis is first presented in the 2002 Report (P1506) and is superseded by the analysis in the 2007 Revision (P2678).⁶⁶

Fundamental flaws in Dr. Ball’s approach produce misleading and potentially

⁶²2002 Report (P1506), p. 15: “In particular, one of the findings of this study shows a circumstantial link between Yugoslav army activities and the observed pattern in killings and refugee flow. The extreme decline in the number of killings and refugee flow observed during the period 6–7 April coincides with the unilateral ceasefire declared by the Yugoslav authorities in recognition of Orthodox Easter. During the period when Yugoslav forces ceased hostilities, the number of killings and refugee departures fell drastically.”

⁶³Milutinovic et al. (IT-05-87 PT), 10297:18–10298:13.

⁶⁴0324-8872-0324-9015 (also available at http://shr.aaas.org/kosovo/killing/md_pub.csv), only records with an identifiable date of death were used.

⁶⁵2002 Supplement (P1391), p. 1: “This analytic technique (which we will call the peaks-versus-presence method) can show that a given pattern (the cause) was absent during the date when the proposed effect was at its maximum. If the hypothesized cause is absent from the period preceding the maximum, then the causal hypothesis should be rejected.”

⁶⁶2002 Report (P1506), Figures 8 and 9, pp. 8, 11–13; 2007 Revision (P2678), Table 1, pp. 1–6, 10–24.

prejudicial results. Indeed, he does not dispute that the presentation of the approach and its results are misleading and he testified that he does not “agree” with the analysis.⁶⁷ Moreover, Dr. Ball testified that the approach cannot distinguish between spurious and real relationships.⁶⁸ Thus, the approach is useless in guiding the Tribunal’s findings.

12.1 “Peaks versus presence” is not a valid type of statistical analysis

Dr. Ball’s “peaks versus presence” approach is not a valid statistical test. It does not generate any test statistic or criteria for rejecting the null hypothesis. Dr. Ball suggests as much in his testimony to the Tribunal: there is no way to reject his hypotheses.⁶⁹ A hypothesis that cannot be rejected is a meaningless hypothesis and a test that cannot be used to reject a hypothesis is a useless test. As such, Dr. Ball’s “peaks versus presence” approach does not satisfy the fundamental requirements for valid statistical analysis.

12.2 Dr. Ball’s approach ignores most of the available data

Dr. Ball’s “peaks versus presence” approach examines whether KLA or NATO activity coincided with or preceded by 2 or fewer days the *peak* date of migration or reported deaths in each of 29 municipalities. Dr. Ball provides no rationale for

⁶⁷Milutinovic et al. (IT-05-87 PT), 10251:9–17:

Judge Bonomy: What you’re saying is you’re presenting something misleading for completeness and I’m having difficulty with this concept why one would do that in the first instance.

A. (Dr. Ball): Well, I guess only because I was asked. I don’t really agree with it and I would prefer to look at a more complex measure, such as that presented in the second appendix of my first report; I believe that is the measure which takes into consideration all of this variation and all of the necessary complexity to understand the relationship among these four patterns.

⁶⁸Milutinovic et al. (IT-05-87 PT), 10247:19–23: “It is unfortunate that analysis such as that presented in table 1 is unable to distinguish between the spurious coincidences, such as that I describe in the rising sun metaphor, and real patterns such as those that would be found in the regression analysis presented in the original report in 2002.”

⁶⁹Milutinovic et al. (IT-05-87 PT), 10341:5–10343:25, specifically: “Even if all 29 municipalities coincided with one specific peak, with the peak in that municipality, if there were NATO and KLA activity coinciding with that peak, that would be an inadequate basis for finding that NATO or KLA activity were the cause of that activity.”

examining only a small subset of the available data he constructed, especially when he recognizes the importance of evaluating the entire series of data. For example, Dr. Ball testified, “My response is it’s not just the coincidence of the peaks that matters. We need to see both the coincidence when there’s a positive effect and the coincidence when there’s a negative effect.”⁷⁰

Another reasonable analysis would be to test whether the *accumulation* or *interaction* of KLA and NATO activities contribute to deaths and migration. For example, a single battle involving the KLA or a single NATO airstrike may have a negligible effect on deaths and migration. Several days of KLA or NATO activities may, however, be associated with increasing numbers of deaths or migration. Similarly, a combination of KLA and NATO activities may be associated with higher numbers of deaths or migration. Dr. Ball’s “peaks versus presence” approach does not test such reasonable possibilities.

12.3 Dr. Ball’s approach produces misleading and potentially prejudicial conclusions

Dr. Ball’s approach cedes common sense to mechanical tabulation.⁷¹ In some municipalities, a single death is considered the “peak” in the number of deaths.⁷² In other municipalities, fewer than 10 individuals leaving is considered the “peak” in migration.⁷³ The flaws in Dr. Ball’s migration estimates described in Section 7 are highlighted and compounded in his “peaks versus presence” approach. For example, no one was recorded crossing the Morina border from either Leposavic or Novo Brdo (Exhibits 4 and 5). Even so, Dr. Ball presents estimates of the date and number of individuals leaving these municipalities with such precision that he can specify the date and size of “peak” migration from these municipalities.

Dr. Ball’s approach demonstrates the computing and statistical concept informally known as *garbage-in/garbage-out*. Feeding nonsensical or irrelevant information into a computing machine can produce only nonsensical or meaningless results.

⁷⁰Milutinovic et al. (IT-05-87 PT), 10343:17–20.

⁷¹2007 Revision (P2678), p. 2: “However, to further increase precision, the analysis was automated: all conclusions regarding the relationship between KLA or NATO activity and peaks in refugee flow and killing were machine-generated.”

⁷²2007 Revision (P2678), pp. 10–24, specifically figures for Gora, Kamenica, and Zubin Potok.

⁷³Id., specifically Strpcë and Zvecan.

Nonsensical and meaningless results, however, are key to Dr. Ball's conclusions in the 2007 Revision (P2678). For example, he concludes that in 7 of 29 municipalities, the peaks in migration and killing could *not* have been caused by KLA or NATO activity.⁷⁴ Six of the 7 municipalities are identified in Section 7.4 as having some fundamental flaw with the input data. None of the 7 municipalities are mentioned in the Indictment for alleged deportations or alleged murders. Exhibit 7 indicates these municipalities account for very few of the recorded deaths: 6 of the 7 municipalities had 5 or fewer total recorded deaths. Exhibit 6 indicates that these municipalities account for very few of those recorded crossing the Morina border: no one is recorded crossing from 2 of the 7 municipalities; fewer than 30 crossed from each of 4 of the remaining 5 municipalities. Dr. Ball's application of his "peaks versus presence" approach to these municipalities produces nonsensical and meaningless results. Reliance on this approach and its results produces misleading and potentially prejudicial conclusions.

13 Flaws in Dr. Ball's linear regression analysis

Dr. Ball provides two sets of linear regression results. The first set is in the 2002 Report (P1506) and the second set is in the 2002 Corrigendum (P1394). Appendix 2 of the 2002 Report (P1506) describes his data and approach.

From his regression analysis, the 2002 Report (P1506) concludes there is no relationship between deaths and KLA or NATO activities and that there is "some evidence" of an association between KLA activities and migration.⁷⁵ Dr. Ball asserts that none of the corrections in the 2002 Corrigendum (P1394) alter the conclusions of the 2002 Report (P1506).⁷⁶

Dr. Ball's conclusions are based on his finding weak relationships among the variables in his linear regressions. A statistician following the scientific method designs his or her approach such that the stronger the regression results, the more likely his or her conclusions are supported. As such the statistician has an incentive

⁷⁴2007 Revision (P2678), p. 4: "Seven of the twenty-nine municipalities (Gora, Kosovska Kamenica, Leposavic, Novo Brdo, Obilic, Strpce, and Zvecane) experienced no KLA or NATO activity prior to the peak period of migration or killings, indicating that in these municipalities, the peaks in migration and killing could not have been caused by KLA or NATO activity."

⁷⁵2002 Report (P1506), p. 59.

⁷⁶2002 Corrigendum (P1394), p. 2.

to develop a model that provides a “good fit” of the data. Contrary to standard statistical practice following the scientific method, Dr. Ball has designed his approach such that the *weaker* the regression results, the *stronger* his conclusions. Such an approach reduces the incentive to develop a model that produces a “good fit” of the data.

The remainder of this section describes some of the fundamental flaws in Dr. Ball’s linear regression approach and the data he uses. The results of these flaws are biased—and in some cases nonsense—estimates that are prejudicial to the Accused.

13.1 Dr. Ball’s regression results cannot be duplicated

Dr. Ball has not provided data supporting the regression results in the 2002 Report (P1506). It is, therefore, impossible to attempt to duplicate these results.

Data supporting the analysis presented in Figure 19 of the 2002 Corrigendum (P1394) have been made available to allow for attempts to duplicate Dr. Ball’s results. Even so, most of the linear regression results presented in the 2002 Corrigendum (P1394) cannot be duplicated. At a minimum, Dr. Ball should have provided sufficient information so that someone reasonably skilled in the practice of statistics could duplicate his results. Dr. Ball however, provides only limited information on how his linear regressions were performed. For example, he does not describe the range of dates covered by the analysis and does not explain his assumptions regarding missing observations and observations that have a value of zero. As a result, Exhibit 11 shows that only 1 of the 4 linear regression models presented in the 2002 Corrigendum (P1394) could be duplicated. Thus, most of Dr. Ball’s results are unverifiable and cannot be relied upon for evaluating the relationships among deaths and migration and KLA and NATO activities.

13.2 Dr. Ball mixes the recorded number of deaths with his inflated estimates

Sections 7 and 8 describe the fundamental flaws in Dr. Ball’s estimates of migration and the number of deaths. These estimates are used in Dr. Ball’s regression analysis as *dependent variables*—the variable to be explained by the regressions. Dr. Ball

compounds these flaws in his application of the estimates to his linear regression analysis.

Section 8.1 describes the various estimates of the number of deaths used by Dr. Ball. As the dependent variable for his linear regression analysis, Dr. Ball mixes his estimate of the *reported* number of deaths with his *inflated estimate* of the number of deaths.⁷⁷ The result is a statistically unreliable mishmash of estimates from different sources.⁷⁸ Indeed, such a mistake would tend to reduce the statistical significance of the regression results. Dr. Ball interprets the lack of statistical significance as evidence that KLA and NATO activities are *not* associated with Kosovo Albanian deaths or migration. Thus, Dr. Ball's error ultimately produces results supporting conclusions that prejudice the Accused.

13.3 Dr. Ball omits a key explanatory variable resulting in biased estimates

Dr. Ball hypothesizes that a "systematic campaign" by FRY forces caused Kosovo Albanian deaths and migration. However, his linear regressions include no data on FRY forces or force movements.⁷⁹ Thus, Dr. Ball's regressions omit a variable that he hypothesizes to be a relevant—if not the most relevant—determinant of Kosovo Albanian deaths and migration.

A linear regression that omits a relevant explanatory variable is misspecified. As a result of the misspecification, the estimated coefficients in Figure 19 of the 2002 Report (P1506) and 2002 Corrigendum (P1394) are wrong. Dr. Ball's models produce biased and inconsistent estimates of the relationships between deaths and refugee flow and KLA and NATO activities.⁸⁰ That is, the estimated impact of

⁷⁷0324-8869: "*nsum*: The total estimated deaths for this two-day period. Note that this value is simply the reported deaths when *modelspec* is missing. The cell counts from which this was estimated can be computed using the raw data." See also 0324-8870.

⁷⁸Consider the following analogy. One can measure the heights of everyone in a room using centimeters or inches. Each technique produces different results (i.e., the centimeter measurements would be approximately 2.5 times greater than the inch estimates). The shape of the distributions of heights, however, would be similar. Using each in a regression analysis would produce identical results (after adjusting for the differences in scale). Even so, one cannot mix the centimeter measurements with the inch measurements. Such a mishmash of measurements would produce meaningless results.

⁷⁹Milutinovic et al. (IT-05-87 PT), 10289:10–10290:9.

⁸⁰An *unbiased* estimator is one in which the expected value of the estimator is equal to the "true" value. A *consistent* estimator is one in which the probability distribution collapses to a single point

KLA activities and NATO activities on deaths and refugee flow are not equal to the “true” impact. Moreover, this bias does not disappear with larger samples.

Dr. Ball’s model produces biases that make it more likely that he would find *no* relationship between deaths and refugee flow and KLA and NATO activities. Omitting a relevant explanatory variable causes the estimated variance to be biased upward—the estimated variance is higher than the “true” variance. Thus, standard hypothesis testing procedures are more likely to yield misleading conclusions about statistical significance. Specifically, the upward bias makes it more likely one would conclude that there is *no* relationship between deaths and refugee flow and KLA and NATO activities when there truly may be one. Thus, the biases produced by Dr. Ball’s omitting a relevant variable prejudice the Accused.

Ball testified that data on FRY forces activities was “too skimpy, too scarce, too patchy, to be considered sufficient.”⁸¹ Without reliable information on FRY forces activities by date and time, it is impossible statistically to draw any conclusions regarding the activities’ contribution to Kosovo Albanian deaths and migration. Indeed, without reliable information on FRY forces activities—even if all the other variables (e.g., deaths, migration, KLA activities, and NATO activities) were appropriately and reliably measured—statistical analysis could not be used to draw any meaningful conclusions regarding FRY forces, KLA, or NATO activities’ contribution to Kosovo Albanian deaths and migration.

13.4 Dr. Ball does not consider reasonable alternative specifications

The Tribunal indicated some interest in whether it was possible to test the interaction of KLA and NATO activities. Dr. Ball suggests a relationship between FRY and KLA activities.⁸² Dr. Ball testified that he did not test for the interaction and that such a test was not possible. His rationale is that an interaction effect can be

(equal to the “true” value) as the sample size gets larger. An estimator that is biased, but consistent will tend to the “true” value with larger samples. However, an inconsistent estimator will not benefit from larger samples.

For a discussion of the consequences of omitting a relevant variable see, for example, Maddala, G. S., *Econometrics*, McGraw-Hill, 1977, chapter 9.5.

⁸¹Milutinovic et al. (IT-05-87 PT), 10290:15–16.

⁸²Statistics/Slobodan (3D520), p. 22: “We were unable, however, to obtain data on Yugoslav army activity independent of interactions with the KLA.”

tested only if the individual components are statistically significant.⁸³ His rationale is contradicted by peer-reviewed literature that describes the addition of an interactive term as a “low-risk” strategy that improves the prospects of finding statistically significant relationships.⁸⁴

By excluding a potentially relevant interaction variable—in addition to omitting a variable measuring FRY activities—Dr. Ball compounds the omitted variable biases discussed in the previous section. Such biases produce results that prejudice the Accused.

13.5 Linear regression is an incorrect model and produces nonsensical results

It would be impossible to observe negative migration or a negative number of deaths. In statistics such distributions are known as *censored* distributions. In this case, they are censored at zero: observations less than zero do not (cannot) exist.

In cases of censored dependent variables a linear regression model cannot produce statistically valid results. In particular, the estimated coefficients in Figure 19 of the 2002 Report (P1506) and 2002 Corrigendum (P1394) are wrong. Dr. Ball’s models produce biased and inconsistent estimates of the relationships between deaths and refugee flow and KLA and NATO activities.⁸⁵ That is, Dr. Ball’s models incorrectly estimate the relationships between deaths and migration and KLA and

⁸³Milutinovic et al. (IT-05-87 PT), 10416:2–10419:11.

⁸⁴Friedrich, R. J., “In defense of multiplicative terms in multiple regression equations,” *American Journal of Political Science*, 1982, 26(4):797–833 at 827:

Third, in situations in which tests of statistical significance are appropriate, the reduction of the standard error of estimate will work to reduce the standard errors of the coefficients so that, at least at some values of the independent variables, the prospects of finding statistically significant relationships will be improved.

...

Finally, including a multiplicative term is a relatively low-risk strategy. If such a term belongs in the equation, all the advantages just enumerated will be realized. If such a term does not belong, its inclusion will do little harm, the main consequences being an increase in degrees of freedom for regression and a decrease in degrees of freedom for residuals, so that the standard error of estimate and the standard errors of the coefficients will be increased slightly and the values of *t* and *F* will be decreased slightly.

⁸⁵For a discussion of the consequences of using a linear regression on a censored sample see, for example, Kennedy, P., *A Guide to Econometrics*, 1996, MIT Press, 3rd edition, chapter 15.

NATO activities.

The flaws in Dr. Ball's linear regression approach are highlighted by the seemingly nonsense results the regressions produce. In particular, the regressions predict a *negative* number of deaths and migration for several observations. The following table shows that for the one set of results that could be duplicated (Exhibit 11), Dr. Ball's regressions predict a negative migration flow for several observations. A visual inspection of Dr. Ball's residuals indicates that every one of his regressions predicts a negative number of deaths or negative migration for several observations (Exhibit 12).⁸⁶

Date	Estimated Migration
11 May	-1,456
23 May	-4,135

Economists have developed statistical techniques to account for censored data. The Tobit model is one reasonable and widely used alternative technique.⁸⁷ Unlike Dr. Ball's linear regression approach, the Tobit technique can produce unbiased and consistent estimates for censored data. Also, a properly formulated Tobit model will not predict a negative number of deaths and refugee flow.

14 Dr. Ball's residual analysis approach is not an accepted statistical technique

Dr. Ball testified that his conclusions regarding the relationships among deaths and migration and NATO and KLA activities rest on his residuals analysis rather than his "peaks versus presence" approach.⁸⁸ His residual approach is based on the

⁸⁶2002 Corrigendum (P1394), Figures 10, 11, 20, and 21.

⁸⁷The technique is named after Nobel laureate James Tobin who published the technique in the 1950s.

⁸⁸Milutinovic et al. (IT-05-87 PT), 10359:12-18: "Okay. We're going back into the peaks and troughs analysis here, Mr. Ackerman, and I would hate to repeat my reservations with that analysis again. Instead, let me say that our analysis rejecting the hypotheses of NATO and KLA activity being plausible causes of killing and migration rest on the residuals analysis which is in the original report figures 10 and 11 of which, as far as I can tell, not a question has been raised."

premise that the weaker the explanatory power of his regressions, the more the residuals from the regression will “follow the same pattern” as the dependent variable (i.e., deaths or migrations).⁸⁹ From his residual approach, Dr. Ball concludes: “. . . the overall effect of KLA activity and NATO airstrikes does not much change the killing and refugee flow patterns. This provides further evidence to reject the hypotheses that KLA activity or NATO airstrikes caused the killings or refugee flow.”⁹⁰ Dr. Ball does not mention the corrected residual analysis in the text of the 2002 Corrigendum (P1394).

Whether by accident or by design, Dr. Ball’s flawed approach and flawed data produce regressions with weak explanatory power. Dr. Ball’s residuals are a direct result of his poorly fitting and fundamentally flawed linear regressions. Linear regressions with weak explanatory power will produce residuals similar to the dependent variable. It is therefore impossible to determine from Dr. Ball’s approach and data whether KLA or NATO activities explain deaths and migration.

Dr. Ball provides no statistical analysis of the residuals from any of his linear regressions: he reports no test statistic with which a null hypothesis can be rejected or not rejected. Instead, he merely “eyeballs” graphs of residuals and the dependent variables and subjectively determines the “strength” of the relationship.⁹¹ If the underlying regressions were valid, statistical analysis of the residuals could have provided an objective and verifiable test of Dr. Ball’s hypothesis. He, however, reports no statistics or statistical tests supporting his conclusions.

Respectfully submitted by:

Eric Fruits, Ph.D.

3 February 2008

⁸⁹2002 Report (P1506), p. 57: “If a regression model describes its dependent variable well, then the pattern of the residuals for that regression model will be random. If, however, the regression model does not describe its dependent variable well, then the residuals will follow the same pattern over time as the original dependent variable.”

⁹⁰2002 Report (P1506), p. 15.

⁹¹See, for example, 2002 Report (P1506), p. 57: “In Figure 21, the relationship between the residuals and migration flow is evident, but in but not as strong as the relationship between the residuals and killings for the previous model.”

A Documents and information relied upon

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2. A supplemental analysis to P1506, 19 February 2002 (P1391).
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4. *Revisiting "Killings and Migration in Kosovo:" Responses to Additional Data and Analysis*, co-authored with Meghan Lynch and Amelia Hoover, 28 January 2007 (P2678).
5. *Policy or Panic: The Flight of Ethnic Albanians from Kosovo, March–May 1999*, 2000 (3D516). Citations to 3D516 are solely to Appendix A, which is found on e-court at 3D 01-0272-0306.
6. "Statistics and Slobodan: Using Data Analysis and Statistics in the War Crimes Trial of Former President Milosevic," co-authored with Jana Asher, *Chance*, 2002 (3D520).
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3. 0324-8869.
4. 0324-8870.

5. 0324-8872 through 0324-9015 (also available at http://shr.aaas.org/kosovo/killing/md_pub.csv).
6. 0324-9071 through 0324-9135 (also available at <http://shr.aaas.org/kosovo/migration/migration-est.csv>).
7. 0324-9136 through 0324-9477 (also available at <http://shr.aaas.org/kosovo/migration/morina-border.csv>).
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2. BBC, “Border shut on refugee tide,” 29 March 1999, <http://news.bbc.co.uk/1/hi/world/europe/306703.stm>, retrieved 27 September 2006.
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4. Eddy, M., Ethnic Albanians stuck at railway stations, refugees say, Associated Press Worldstream, 13 May 1999.
5. FDCH Political Transcripts, “James Rubin holds State Department news briefing,” 7 April 1999.
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13. Myre, G., "Kosovo refugees pour into Albania," Associated Press Online, 21 May 1999.
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Exhibit 1: Curriculum vitae of Eric Fruits, Ph.D.

Education

Ph.D., Economics Claremont Graduate University	1997
M.A., Economics Claremont Graduate University	1993
B.S. with Distinction, Business Economics & Public Policy Indiana University	1990

Present Positions

Economics International Corp., Director www.econinternational.com	2006–present
ECONorthwest, Senior Economist	2002–present
Portland State University, Adjunct Professor School of Business Administration School of Urban Studies and Planning web.pdx.edu/~fruits/	2002–present

Testimony in Legal Proceedings

Erik E. Tolleshaug v. Shaver Transportation Co. Circuit Court for the State of Oregon for the County of Multnomah, No. 060809122. Trial testimony December 14, 2007.

In re: The Marriage of Denise M. Kunze and Gust F. Kunze. State of Washington Clark County Superior Court, No. 05-3-00801-3. Trial testimony October 29, 2007.

Securities and Exchange Commission v. Philip Evans and Paul Evans. U.S. District Court for the District of Oregon. No. CV 05-1162-PK. Deposition testimony February 27, 2007; Trial testimony March 8, 2007.

Randall D. Lam v. Kaiser Foundation Hospitals; Northwest Permanente, P.C.; Kaiser Foundation Health Plan of the Northwest; Robert James Shneidman, M.D.; and David Lee Brown, Jr., P.A. Circuit Court for the State of Oregon for the County of Multnomah. No. 020706633. Trial testimony November 9, 2006.

Vitascan Partners I and Vitascan Partners II v. G.E. Healthcare Financial Services and GE/Imatron. Superior Court for the State of California. No. 01129909. Trial testimony July 24, 2006.

Squaxin Island Tribe, Island Enterprises, Inc., Swinomish Indian Tribal Community, and Swinomish Development Authority v. Fred Stephens, Director, Washington State Department of Licensing. U.S. District Court for Western District of Washington. No. C033951Z. Deposition testimony June 15, 2005.

Androutsakos v. M/V PSARA, PSARA Shipping Corporation, and Chevron U.S.A., Inc. United States District Court for the District of Oregon. No. 02CV1173KI. Trial testimony May 21, 2004.

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CollegeNET, Inc., v. ApplyYourself, Inc. United States District Court for the District of Oregon. Nos. 02CV484HU and 02CV1359HU. Daubert hearing May 9, 2003.

Public Testimony and Presentations

Taxpayer Coalition. Forecast of U.S. and Oregon economies. May 9, 2007.

Oregon Senate Interim Commission on Health Care Access and Affordability. October 27, 2006.

Oregon Land Conservation and Development Commission. Umatilla County Request for Approval of Resource Zone Minimum Lot Size. Agenda Item 7. June 29, 2006.

Yamhill County Planning Commission. Request by Hazel B. Timmons Trust for Approval of a Comprehensive Plan Amendment. Docket PAZ0106. March 2, May 4, and June 7, 2006.

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Hillsboro Planning & Zoning Board Hearings Board. File No. ZC2302, Request by Providence Health System Oregon for Zoning Map Amendment from SCI to SCRP. Hillsboro, Oregon. November 6, 2002. Hillsboro City Council. Work Session Item A: Tuality Hospital. Hillsboro, Oregon. October 15, 2002.

Publications, Reports, and Other Papers

“A comprehensive evaluation of the comparative cost of negotiated and competitive methods of municipal bond issuance.” Accepted for publication at *Municipal Finance Journal*, with R. J. Pozdena, J. Booth, and R. Smith. 2008.

“Do we really have a health-care crisis?” *Oregon Business*. January 2008.

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Committee Service

State of Oregon Department of Environmental Quality. Fiscal Advisory Committee for the Proposed Adoption of the Utility Mercury Rule and Other Federal Air Quality Regulations. 2006.

City of Portland. Mayor's Ad Hoc Work Group on Regulatory Reform. 2002.

Professional Experience

LECG, LLC Senior Economist	1999–2002
Claremont Graduate University Adjunct Professor of Economics and Visiting Scholar	1996–2002
Econ One Research, Inc. Economist	1998–1999
University of Southern California, Marshall School of Business Visiting Assistant Professor of Finance & Business Economics	1997–1998
Indiana University, Kelley School of Business Visiting Assistant Professor of Business Economics & Public Policy	1997
Scripps College Adjunct Professor of Economics	1996
Pomona College Lecturer in Economics	1994
Andersen Consulting Staff Consultant	1990–1991

Grants and Awards

Lionel Edie Award	1990
Lynde and Harry Bradley Foundation Grant	1992–1995
John Randolph Haynes and Dora Haynes Foundation Grant	1995
Institute for Humane Studies Research Grant	1996

Courses Taught

Microeconomics

Industrial Organization

Economics of Regulation and Antitrust

Managerial Economics

Econometrics

Real Estate Finance and Investment

Exhibit 2: Kosovo municipalities and ethnic majorities



Yugoslav Census (1991)		
Albanian	1,596,072	81.6%
Serbian	194,190	9.9%
Muslim	66,189	3.4%
Roma	45,745	2.3%
Other	53,989	2.8%
Total	1,956,185	

NOTE
The majority of ethnic Albanians boycotted the 1991 census. The table on the left reflects official estimates made by the Yugoslav Institute of Statistics.

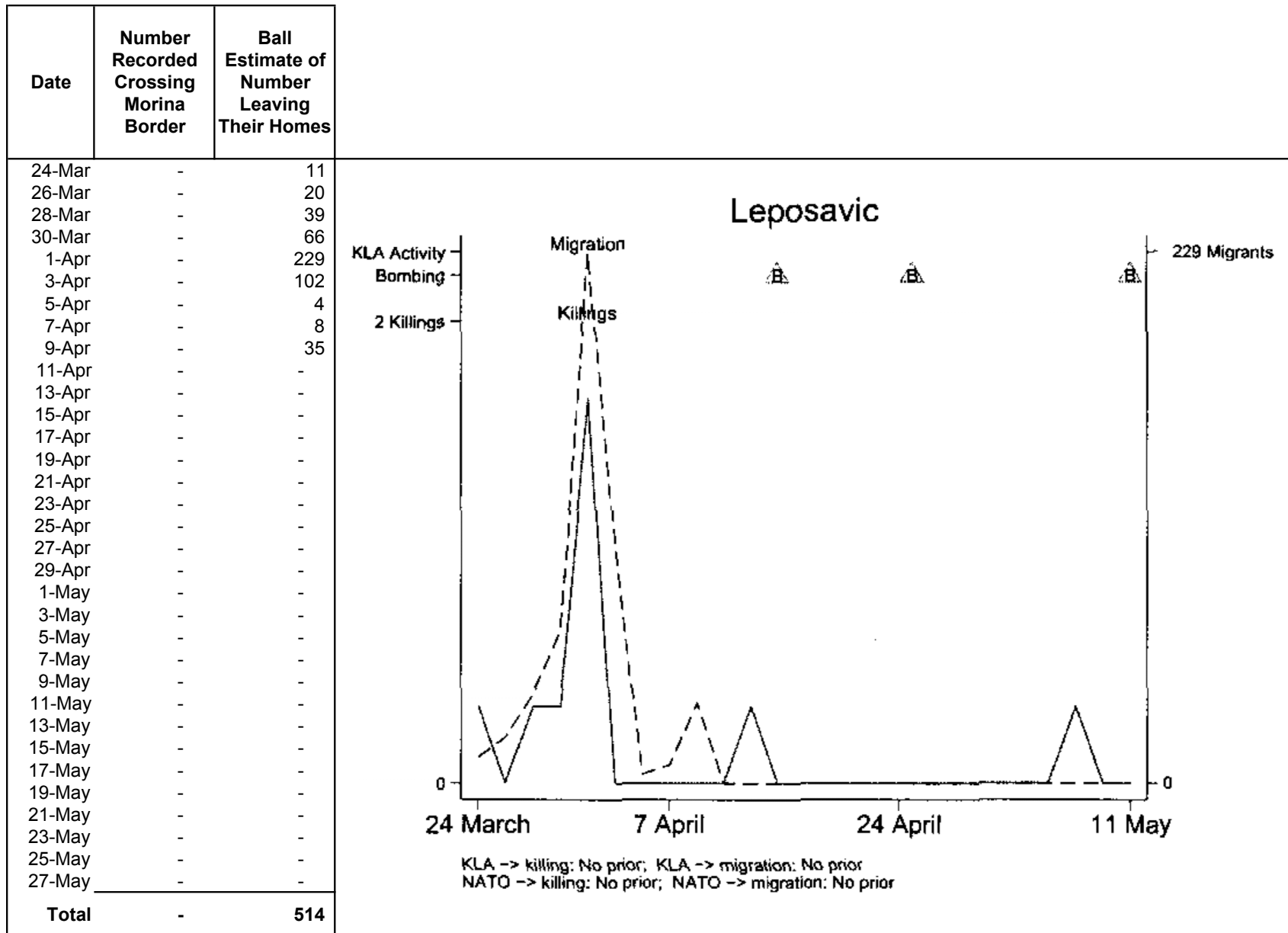
Exhibit 3: Kosovo population and ethnicities, 1981 and 1991

Municipality (Ball Report)	Municipality (Statistical Office of Kosovo)		1981	1991				
				Total	Albanian	Serb	Muslim	Other
* Decani	Decani	Deçan	40,640	49,000	97%	0%	1%	2%
* Djakovica	Djakovica	Gjakovë	92,203	115,097	93%	2%	0%	5%
Glogovac	Glogovac	Glllogoc	39,141	53,618	100%	0%	0%	0%
* Gnjilane	Gnjilane	Gjilan	84,085	103,675	77%	19%	0%	4%
Gora	Dragas	Dragash	35,054	39,435	58%	0%	41%	1%
* Istok	Istok	Istog	50,104	57,261	77%	10%	7%	6%
* Kacanik	Kacanik	Kaçanik	31,072	38,010	98%	1%	0%	1%
Klina	Klina	Klinë	43,894	52,266	83%	10%	1%	6%
Kosovo Polje	Kosovo Polje	Fushë Kosovë	29,805	35,570	57%	24%	5%	14%
Kosovska Kamenica	Kamenica	Kamenicë	48,320	52,152	73%	24%	0%	3%
* Kosovska Mitrovica	Mitrovica	Mitrovicë	87,981	104,885	79%	9%	5%	7%
Leposavic	Leposavic	Leposaviq	16,906	16,395	6%	87%	5%	2%
Lipljan	Lipljan	Lipjan	56,940	69,451	77%	14%	1%	8%
Novo Brdo	Novo Brdo	Novobërdë	4,984	4,611	40%	58%	0%	2%
Obilic	Obilic	Obiliq	27,161	31,627	66%	17%	1%	16%
* Orahovac	Orahovac	Rahovec	46,541	59,877	92%	6%	0%	2%
* Pec	Pec	Pejë	111,071	127,796	75%	6%	8%	11%
Podujevo	Podujevo	Podujevë	75,437	92,946	98%	1%	0%	1%
* Pristina	Pristina	Prishtinë	148,090	199,654	78%	13%	2%	7%
* Prizren	Prizren	Prizren	134,526	178,723	76%	6%	11%	7%
* Srbica	Srbica	Skenderaj	46,777	55,471	98%	1%	0%	1%
* Stimlje	Stimlje	Shtime	20,193	23,506	92%	4%	2%	2%
Strpce	Strpcë	Shtërpcë	12,115	12,712	34%	64%	0%	2%
* Suva Reka	Suva Reke	Suharekë	50,444	64,530	95%	5%	0%	0%
* Urosevac	Urosevac	Ferizaj	81,372	113,668	88%	7%	2%	3%
Vitina	Vitina	Viti	47,839	57,290	79%	12%	0%	9%
* Vucitrn	Vucitrn	Vusttrri	65,512	80,644	88%	7%	1%	4%
Zubin Potok	Zubin Potok	Zubin Potok	8,666	8,479	25%	74%	0%	1%
Zvecane	Zvecan	Zveçan	8,675	10,030	19%	76%	1%	4%
n/a	Malisevo	Malishevë	38,892	47,817	99%	1%	0%	0%
Total			1,584,440	1,956,196	82%	10%	3%	5%

*Municipality is identified in the Indictment

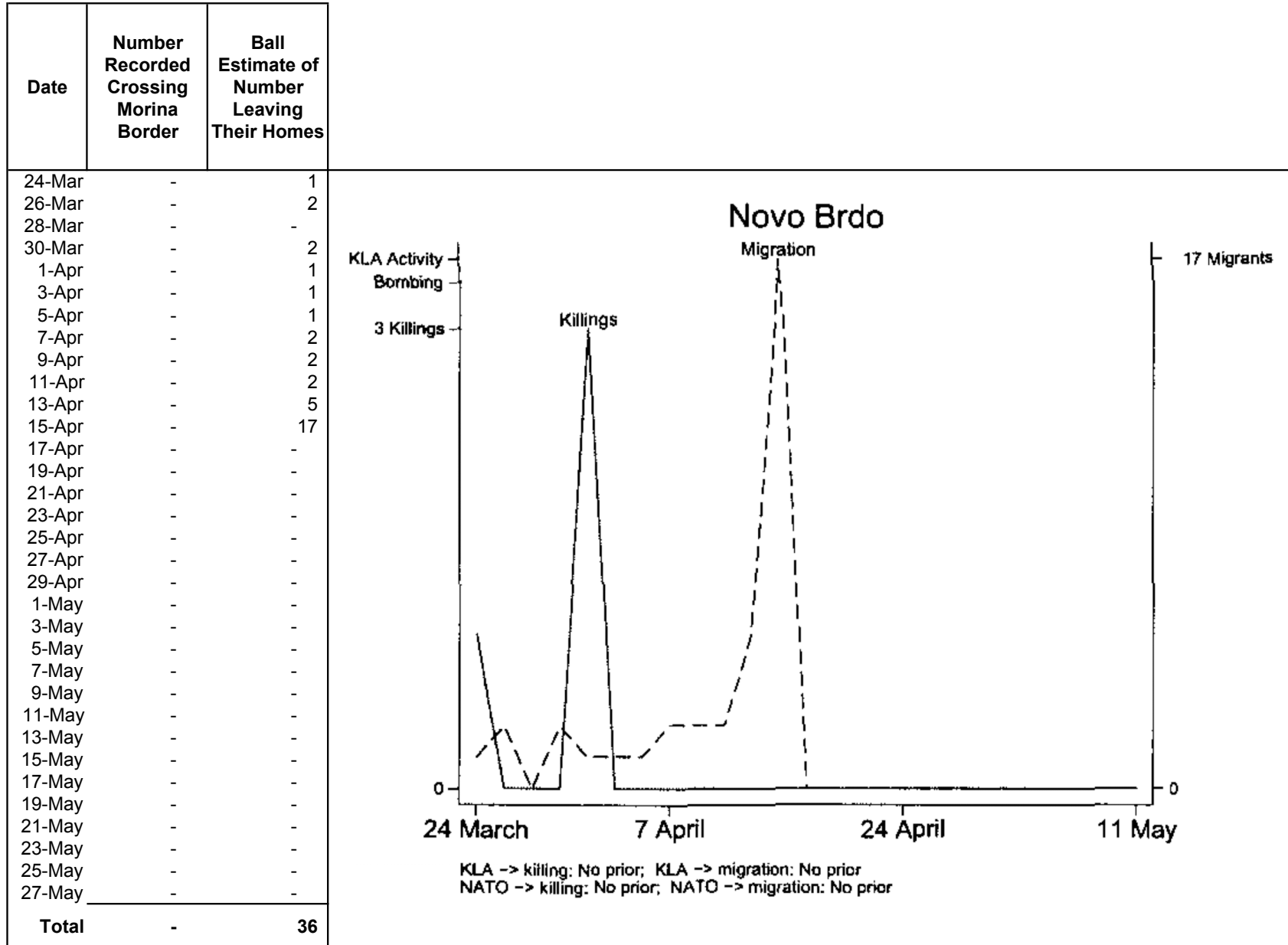
Source: Statistical Office of Kosovo. Kosovo and Its Population, September 2003.

Exhibit 4: Migration from Leposavic, Morina border crossing records and Dr. Ball estimates



Source: morina-border.csv (0324-9136 - 0324-9477); migration-est.csv (0324-9071 - 0324-9135); 2007 Revision, p. 15

Exhibit 5: Migration from Novo Brdo, Morina border crossing records and Dr. Ball estimates



Source: morina-border.csv (0324-9136 - 0324-9477); migration-est.csv (0324-9071 - 0324-9135); 2007 Revision, p. 16

Exhibit 6: Migration from Kosovo by municipality, Morina border crossing records and Dr. Ball estimates

Municipality	Number Crossing Border	Ball Estimate of Number Leaving Their Homes	Difference
Decani/Deçan	14,187	15,874	1,687
Djakovica/Gjakovë	16,761	30,115	13,354
Glogovac/Gllogoc	200	702	502
Gnjilane/Gjilan	441	2,959	2,518
Dragas/Dragash	17,927	19,315	1,388
Istok/Istog	4,992	12,665	7,673
Kacanik/Kaçanik	1	515	514
Klina/Klinë	3,012	7,592	4,580
Kosovo Polje/Fushë Kosovë	8,019	11,502	3,483
Kamenica/Kamenicë	27	103	76
Mitrovica/Mitrovicë	16,142	27,454	11,312
Leposavic/Leposaviq	-	514	514
Lipljan/Lipjan	4,646	6,850	2,204
Novo Brdo/Novobërdë	-	36	36
Obilic/Obiliq	18	1,254	1,236
Orahovac/Rahovec	18,364	35,222	16,858
Pec/Pejë	14,425	23,819	9,394
Podujevo/Podujevë	261	344	83
Pristina/Prishtinë	2,122	8,867	6,745
Prizren/Prizren	27,207	62,659	35,452
Srbica/Skenderaj	3,756	7,660	3,904
Stimlje/Shtime	434	375	(59)
Strpcë/Shtërpcë	8	7	(1)
Suva Reke/Suharekë	30,131	44,026	13,895
Urosevac/Ferizaj	1,514	2,222	708
Vitina/Viti	28	19	(9)
Vucitrn/Vusttrri	5,954	10,814	4,860
Zubin Potok/Zubin Potok	101	94	(7)
Zvecan/Zveçan	15	13	(2)
Not recorded	85,768		
Total	276,461	333,591	142,898

Source: morina-border.csv (0324-9136 - 0324-9477);
migration-est.csv (0324-9071 - 0324-9135)

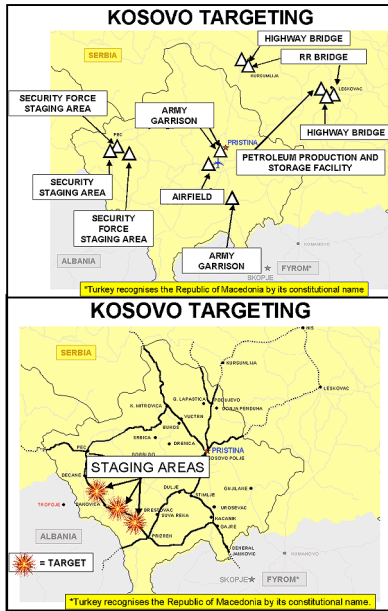
Exhibit 7: Dr. Ball estimates of recorded number of Kosovo Albanian deaths by municipality

Municipality	Recorded Number of Deaths
Decani/Deçan	34
Djakovica/Gjakovë	265
Glogovac/Gllogoc	265
Gnjilane/Gjilan	169
Dragas/Dragash	2
Istok/Istog	121
Kacanik/Kaçanik	227
Klina/Klinë	84
Kosovo Polje/Fushë Kosovë	54
Kamenica/Kamenicë	3
Mitrovica/Mitrovicë	145
Leposavic/Leposaviq	1
Lipljan/Lipjan	185
Novo Brdo/Novobërdë	4
Obilic/Obiliq	49
Orahovac/Rahovec	487
Pec/Pejë	257
Podujevo/Podujevë	104
Pristina/Prishtinë	302
Prizren/Prizren	274
Srbica/Skenderaj	430
Stimlje/Shtime	43
Strpcë/Shtërpçë	3
Suva Reke/Suharekë	327
Urosevac/Ferizaj	156
Vitina/Viti	45
Vucitrn/Vusttrri	194
Zubin Potok/Zubin Potok	2
Zvecan/Zveçan	5
Total	4,237

Includes only observations with identifiable date of death
Source: md_pub.csv (0324-8872 - 0324-9015)

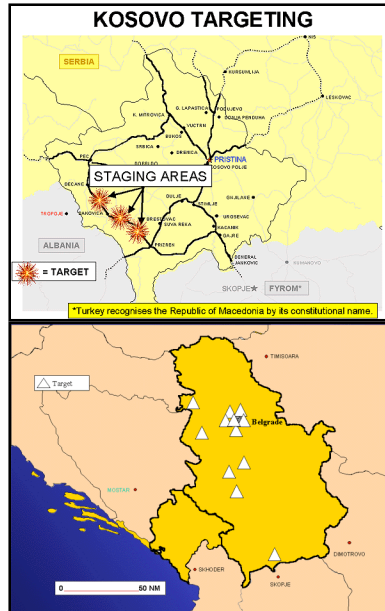
Exhibit 8: Actual NATO airstrikes on selected dates in which Dr. Ball's data record none

3 April



<http://www.nato.int/pictures/1999/990402/b990402e.gif>
<http://www.nato.int/pictures/1999/990403/b990403d.gif>

4 April



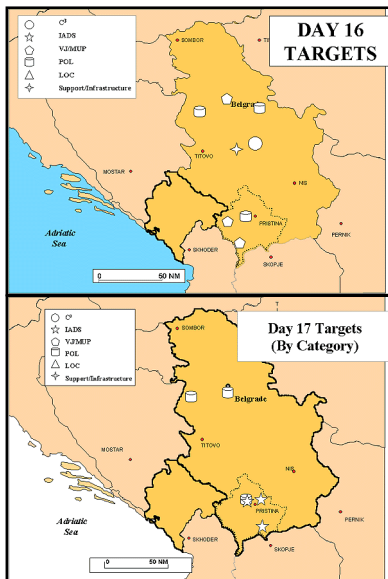
<http://www.nato.int/pictures/1999/990403/b990403d.gif>
<http://www.nato.int/pictures/1999/990404/b990404b.gif>

9 April



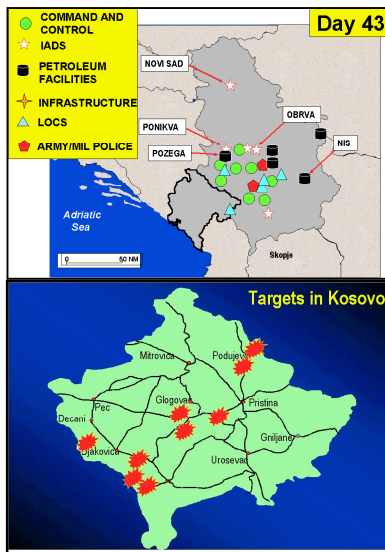
<http://www.nato.int/pictures/1999/990408/b990408c.gif>
<http://www.nato.int/pictures/1999/990409/b990409e.gif>

10 April



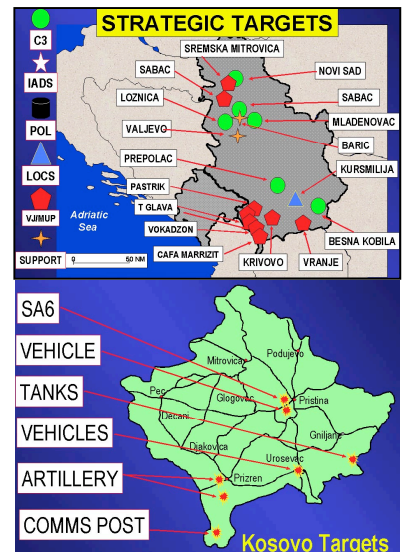
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<http://www.nato.int/pictures/1999/990410/b990410a.gif>

7 May



<http://www.nato.int/pictures/1999/990506/b990506a.gif>
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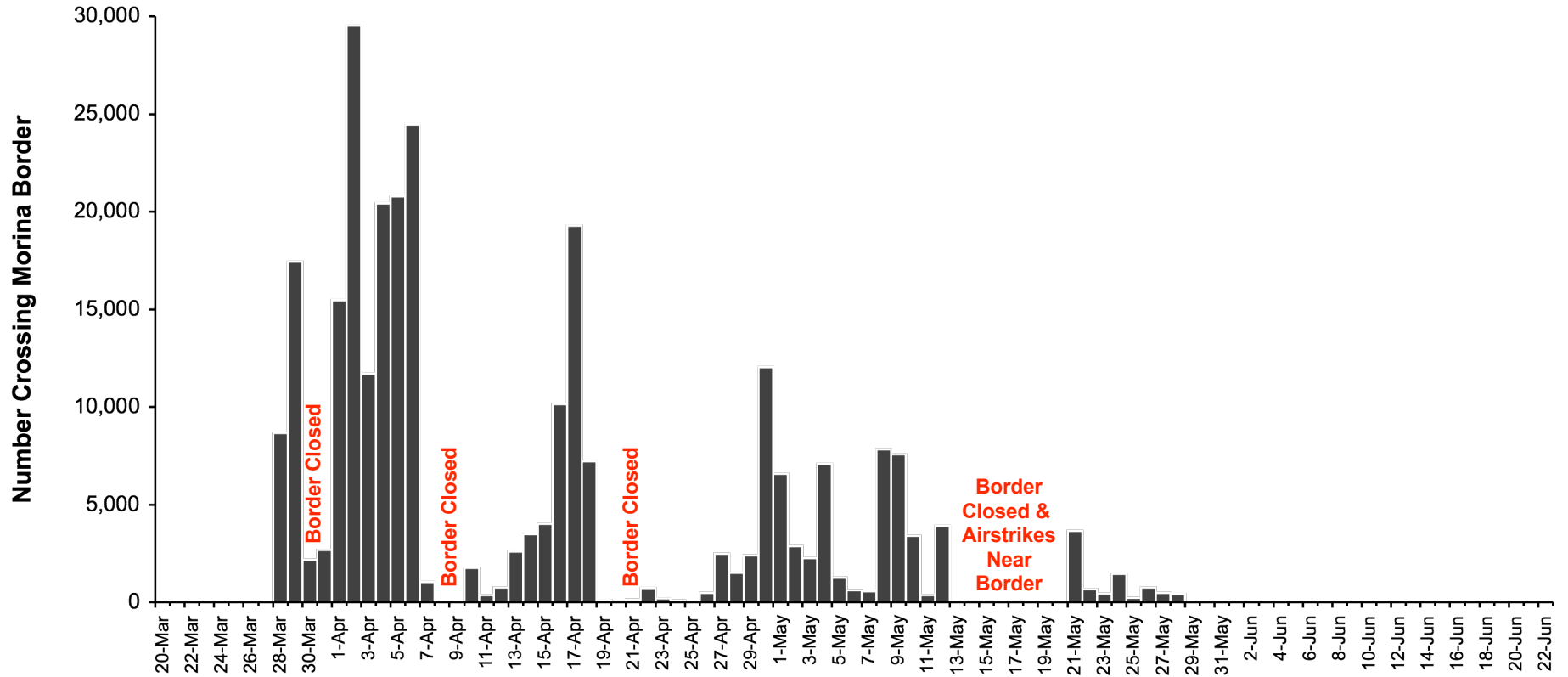
20 May



<http://www.nato.int/pictures/1999/990519/b990519j.jpg>
<http://www.nato.int/pictures/1999/990520/b990520b.jpg>

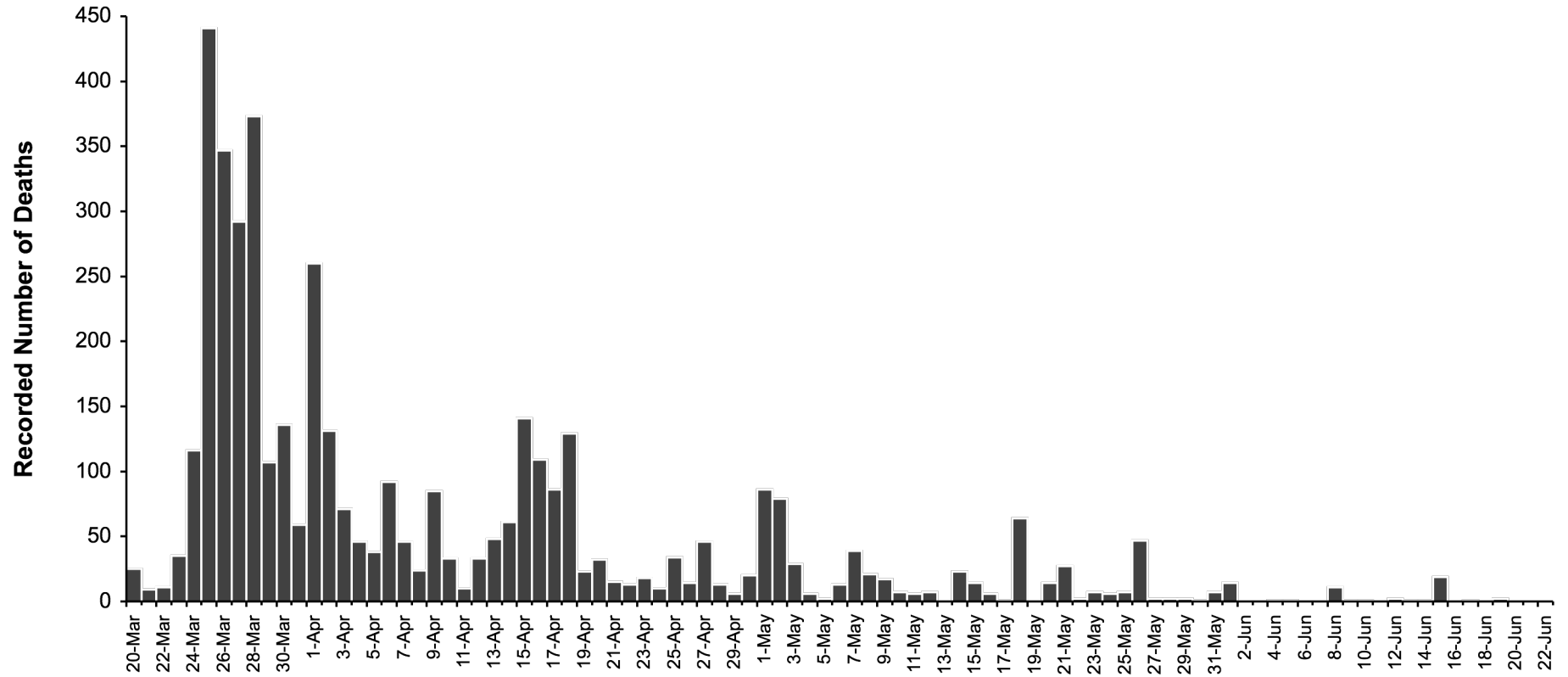
Note: Each date shows NATO map for date of press conference and date preceding press conference

Exhibit 9: Number recorded crossing Morina border and dates of border closing



Source: morina-border.csv (0324-9136 - 0324-9477)

Exhibit 10: Dr. Ball estimates of recorded number of deaths



Includes only observations with identifiable date of death
Source: md_pub.csv (0324-8872 - 0324-9015)

Exhibit 11: Results of attempts to duplicate Dr. Ball's linear regression analysis

Variable	(1) Deaths Over Time			(2) Migration Over Time			(3) Deaths Over Time and Region			(4) Migration Over Time and Region		
	Coeff.	Std. Err.	Prob.	Coeff.	Std. Err.	Prob.	Coeff.	Std. Err.	Prob.	Coeff.	Std. Err.	Prob.
Constant	231.21 ***	72.39	0.00	6125.72	4120.21	0.15	204.98 **	88.00	0.02	-929.87	5511.44	0.87
East region							-39.15	91.63	0.67	4777.24	4667.05	0.31
South region							-190.99 **	86.77	0.03	8206.34	5743.80	0.16
West Region							-207.61 *	104.59	0.05	668.22	4480.25	0.88
KLA - kill	-4.91	4.87	0.32	-410.15	380.24	0.29	10.74	11.97	0.37	182.58	753.15	0.81
KLA - battle	35.36	24.26	0.15	842.41	650.99	0.21	5.73	22.42	0.80	-18.59	1603.24	0.99
KLA - kill (lag)	5.12	4.75	0.29	549.66	490.70	0.27	-0.12	7.83	0.99	782.23	613.20	0.21
KLA - battle (lag)	29.31 **	13.23	0.03	3011.28 ***	878.66	0.00	92.79 *	50.25	0.07	2702.46	2269.77	0.24
NATO	-4.94	6.71	0.47	12.13	231.68	0.96	-4.91	5.05	0.34	-157.68	272.62	0.57
NATO (lag)	-12.39 *	6.83	0.08	-555.43 *	296.05	0.07	-11.57	7.28	0.12	-429.58	391.64	0.28
R-squared	0.38			0.58			0.43			0.38		
Adj. R-squared	0.28			0.49			0.31			0.22		
S.E. of regression	254.31			9701.80			264.05			11764.60		
Sum squared resid.	2.33E+06			2.54E+09			3.07E+06			4.71E+09		
Log likelihood	-295.35			-356.45			-372.20			-469.17		
Durbin-Watson stat.	1.69			1.62			1.56			1.07		
Mean dep. var.	214.73			10259.47			175.92			7488.64		
S.D. dep. var.	299.79			13587.68			317.74			13309.77		
Akaike info crit.	14.06			21.38			14.16			21.78		
Schwarz crit.	14.35			21.69			14.52			22.19		
F-stat.	3.73			6.29			3.64			2.34		
Prob (F-stat.)	0.01			0.00			0.00			0.04		
Number of obs.	43			34			54			44		

* denotes significance at the 10% level of confidence; ** at the 5% level; and *** at the 1% level
 Model 2 duplicates Ball's results

Exhibit 12: Observations in which Dr. Ball's linear regressions predict negative deaths or migration

Figure 10, page 13: Estimated total killings and residuals over time

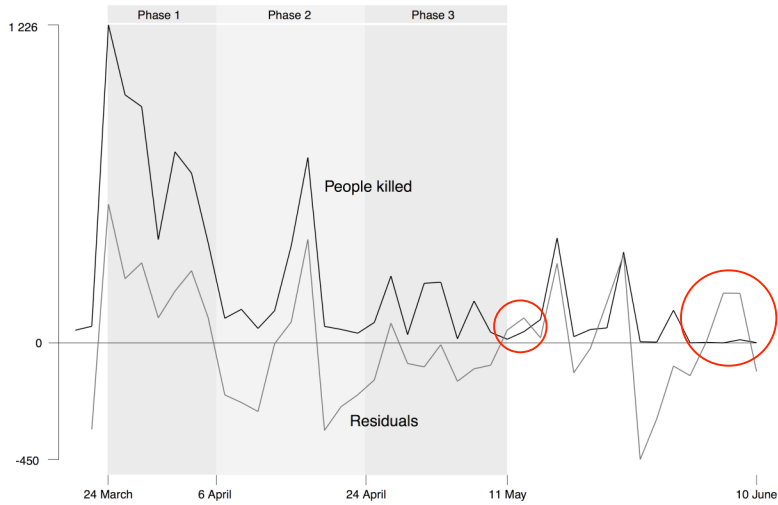


Figure 20, page 59: Estimated total killings and residuals by region over time

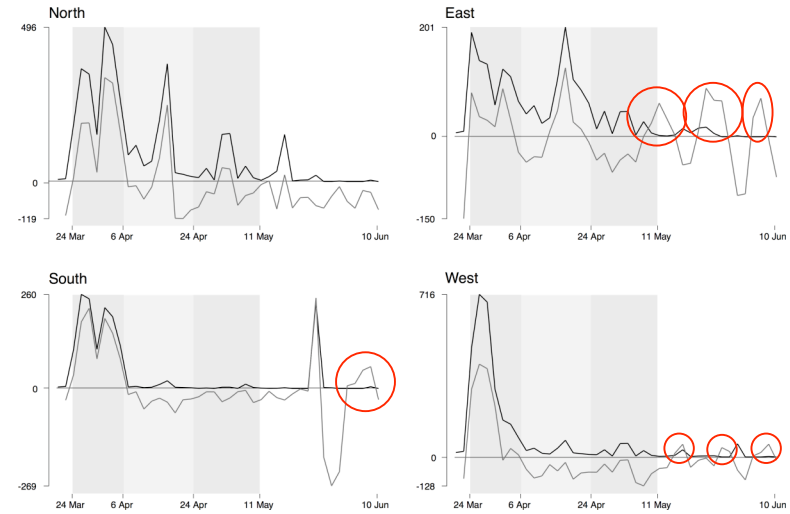


Figure 11, page 14: Estimated total refugee flow and residuals over time



Figure 21, page 60: Estimated refugee flow and residuals by region over time

