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From Pseudoscience to Protoscience: Estimating Human Trafficking and Modern Forms of Slavery

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**From Pseudoscience to Protoscience:
Estimating Human Trafficking and Modern
Forms of Slavery**

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Final Submission Human Trafficking Clinic

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Introduction

Scholars and authors in the field of human trafficking and modern slavery are quick to note the problem of estimating the number of victims. Their works are usually devoid of an appropriate explanation, though, of why there is a problem. Many recognise victims are part of a hidden population and know that they cannot simply be counted. From this they assume that estimates are inherently unreliable. The problem here is not that there are only estimates, but that the estimates are based on either faulty grounds or no apparent methodology at all. Estimation techniques are common in many fields including biology, demography and computer technologies. A continuous development of methodology within these fields has lead to estimates that are considered more reliable. The same progression should occur in the field of human trafficking and modern slavery. To date though, any progression in methodology has been fragmented at best. To improve estimation techniques in the field the next step is to examine these methodologies, critique them and to suggest a way forward. This paper is the beginning of this process.

This paper is laid out in five sections. The first section explains why it is important to measure modern forms of slavery accurately. Ultimately a coherent policy cannot be determined, nor can funds be targeted appropriately if there is not an accurate estimate. The second portion of the paper explains the difficulties in obtaining an accurate estimate. Disagreements about definitions, problems estimating hidden populations, concerns about ethical standards and misunderstandings about statistical and methodological principles lead to these difficulties. The third section presents the actual estimates and methodologies organizations use to determine their estimates. The organizations examined for this paper can be divided into three groups. The first are organizations that only publish the number of assisted victims. The second group is made up of organizations that use another organization's estimates and the third group is the organizations that create their own estimate. These organizations were chosen for this paper because they are

some of the most influential organizations fighting modern forms of slavery today, including the International Organization for Migration (IOM), the United Nations Global Initiative to Fight Human Trafficking (UN.GIFT hereafter), Anti-Slavery International, United States Health and Human Services (HHS), Free the Slaves, United States Department of State (DOS), and the International Labour Organization (ILO). There are problems with each of the three groups, which must be addressed. The scope of this paper only allows for a brief overview of the problems in groups one and two but in depth discussion of the problems in group three, organizations that create their own estimates. The fourth section is the conclusion and the fifth section of the paper proposes recommendations for a way forward. These steps can assist in creating a more accurate estimate and include openly critiquing methodologies and properly using triangulation. The paper also includes three appendixes, which deal more in depth with concepts addressed in the paper.

A few important notes should be made before beginning this paper. Due to the nature and varying focus of each organization, most of the estimates deal with different phenomenon; some organizations examined forced labour, others trafficking and still others slavery. This differentiation has two implications for this paper. First, throughout the paper different terms will be used. During the introduction and the recommendations the term, modern forms of slavery will be used. This is a general term, which encompasses all of the concepts addressed within the paper. When discussing the individual organizations though, whatever term they use for creating their estimate will be the term used within that section. Second, since the paper addresses slightly different concepts, it is important to remember that the estimates themselves are not comparable. In other words, Bales measurement of 27 million slaves should not be compared to the International Labour Organization measurement of 12.3 million in forced labour. They are measuring different concepts. This does not pose a problem for this paper's analysis though since the fundamental methodology used to create the estimates are not inherently based on what term

the organization is using; rather the methodology is applied to data that fits the term. This allows a person to examine the methodologies, critique them and provide recommendations for the field as a whole even though each organization is looking at slightly different forms of modern slavery.

The purpose of this study is not to reiterate the unreliability of the estimates that already exist. Many have done that already. Rather, the purpose is to explain the methods for producing these estimates fully and to detail their limitations. Only when the issues are fully understood, can methodologies be improved. Unfortunately, many in the field do not fully understand the limitations of the estimates or even what the estimates are actually saying. The purpose of this paper is to present these issues in a way that people without training in statistics or methodology can grasp these problems and hopefully they can provide suggestions for improving these methodologies in the future.

Why Is It Important to Measure Accurately?

There is no dearth of estimates of modern forms of slavery. Most estimates though, lack sound methodological backing or are simply devoid of any methodology. Kevin Bales, one of the most widely respected scholars in the field, investigated one such estimate. During a meeting at the United Nations, someone claimed 100 million slaves lived throughout the world. The final report of the meeting published this estimate and thus ensured its future use by organizations and the media. Bales found the estimate's creator who admitted it was simply a guess with no formal estimation or data collection technique.¹

The authors of one report suggested, “a poor indicator is better than no indicator as long as it is not represented as more than it is.”² While it may be true, that any indicator is better than no indicator at all, poor indicators are problematic for policymaking. Mike Dottridge, former

¹ Kevin Bales. *Understanding Global Slavery: A Reader*. Berkeley and Los Angeles California: University of California Press, 2005. 103

² United Nations Office on Drugs and Crime. *Global Report on Trafficking in Persons*. UN.GIFT, UNODC, 2009. 13

director of Anti-Slavery International, suggested that to believe an accurate estimate is not necessary is a “rather idealistic, not to say naïve approach, which ignores the damage that can be done by misrepresenting the scale of a problem. [...] an inaccurate estimate of the problem is likely to result in a remedy being proposed that is equally inappropriate.”³ The policy prescription is quite different for 10,000 victims in modern forms of slavery compared to 1,000,000. Accuracy is essential for creating effective policies for fighting modern slavery and for determining the most effective use for funds. The lack of accurate estimates, not the lack of any estimates is the problem.

Why an Accurate Estimate is Difficult

For a multitude of reasons, it is difficult to obtain accurate estimates within this field. Though some organizations attempt to work around these issues many leave them unaddressed. An accurate estimate must reflect the truth about a population. Population, in this case, refers to every person who is a member of the group as defined. The “population” of concern here is every person who is a victim of modern slavery (or its subset as defined by the organization), not every person on earth. An accurate estimate of the population of people in modern slavery would then reflect the number of people who are actually in slavery. There are four main obstacles or problems, which prevent the creation of an accurate estimate.

The first problem in creating an accurate estimate is that definitions within the field are often contradictory, ill stated, or missing. Definitions should tell the reader who is and who is not a member of the population. Actual cases of modern slavery are usually not black and white though. Sometimes researchers fundamentally disagree about what to measure. As an example, what one person considers a form of modern slavery (such as all forms of prostitution) another may not.

³ Mike Dottridge. *Deserving Trust: Issues of Accountability for Human Right NGOs*. Switzerland: International Council on Human Rights Policy, Switzerland, 2003.

“Divergent definitions will remain a stumbling block, despite the fairly broad definition within the Optional Protocol to the UN Convention on Transnational Organized Crime, adopted by the UN General Assembly, and subsequently widely signed in Palermo in late 2000. Even signatories to the protocol are likely to have different definitions in their national laws, and it is these that are used in the construction of official data. It is even less likely that research participants, trafficked women and children in particular, will be aware of an agreed international definition and they are, therefore, likely to define trafficking in a variety of ways that diverge both from the Palermo definition and various national laws.”⁴

It is unlikely that a consensus on one definition will ever happen because of varying political and social beliefs. It is hard to determine then whether an estimate is accurate because accuracy depends on one’s definition of the population. Some authors choose instead to explicitly state the definition they are using which is helpful but usually these definitions are too simplistic to be useful to the community as a whole and do not help them understand how to categorize grey situations. For example if slavery is a situation in which a person is forced to work and not allowed to leave, would a house maid who is paid nothing, beaten, and forced to work 16 hour days, seven days a week, but is allowed to attend church on Sundays be considered a slave? Even if a group of people agree on one definition, it is likely each person would have a separate interpretation of that definition, creating problems, for instance, when multiple people are working on projects.

The second problem in creating an accurate estimate is that people in forced labour are part of a “hidden population.” “Hidden population” refers to a group of people for which, membership is either socially stigmatized or constitutes a crime. Due to its hidden nature, the creation of an accurate sampling frame, which is used when it is not feasible to count everyone, is not possible.⁵ One requirement of the sampling frame is that members are picked at random and thus the probability of a person being selected is known (or in this case is equal to everyone else’s chance). This probability is uncertain for hidden populations, especially those in modern forms

⁴ Elizabeth Kelly. *Journeys of Jeopardy: A Review of Research on Trafficking in Women and Children in Europe*. London, U.K.: International Organization for Migration, 2002. 9

⁵ Douglas D. Heckathorn. "Respondent Driven Sampling: A New Approach to the Study of Hidden Populations." *Social Problems*, 1997: 174-199. 174

of slavery, because it is difficult to find members of the population at all and people in certain forms of slavery are more likely to be discovered than those in other forms. For example, since women who are sex slaves must interact with customers, they are more likely to be discovered than those forced into domestic service, since the latter often do not have to interact with the outside world. This means the probability of being found is not the same for everyone in the population and therefore normal sampling techniques cannot be used.

Bales notes that it once was much easier to know the number of slaves, because the general population considered the practice of slavery acceptable and governments kept records of those who were enslaved. When slavery was criminalized though, those who wished to keep slaves were forced to hide them. Today criminals will go to great lengths to conceal what they are doing.⁶ This problem was recognised in the sub-field of modern slavery known as human trafficking:

“Due to the covert nature of the crime, accurate statistics on the nature, prevalence, and geography of human trafficking are difficult to calculate. Trafficking victims are closely guarded by their captors, many victims lack accurate immigration documentation, trafficked domestic servants remain “invisible” in private homes, and private businesses often act as a “front” for a back-end trafficking operation, which make human trafficking a particularly difficult crime to identify and count.”⁷

The third problem in creating an accurate estimate is that there are ethical concerns with interacting in the population. Counting or even sampling the population in order to produce an estimate would require knowledge of the crime, whether this is where the victims are located, how many there are or who is keeping them. One would be ethically obligated to report such information to the authorities. Margaret Melrose faced these ethical concerns during her study on

⁶ Kevin Bales. *Understanding Global Slavery: A Reader*. Berkeley and Los Angeles California: University of California Press, 2005. 87-88

⁷ Heather J Clawson, Mary Layne, and Kevonne Small. *Estimating Human Trafficking into the United States: Development of a Methodology*. Submitted to the US Department of Justice, Washington D.C.: Caliber, an ICF International Company, 2006. 2

another hidden population, underage prostitutes.⁸ Interactions with people in slavery, puts both the researchers' and the victims' lives in danger. Additionally, by the researcher reporting any such findings to the authorities, this victim would, hopefully, be freed and therefore no longer be a part of the population. Simply discovering the person should lead to them no longer being a member of the population of interest, which obviously is not bad, but it does negate the purpose of the study.

The fourth problem in creating an accurate estimate is that there seems to be a general lack of understanding of methodological and statistical principles within the field, or at best a misunderstanding. There are certainly exceptions to this rule, but most people do not have a sound background in research or the resources to develop good methodologies. The creation of an estimate based on estimates that are potentially not trustworthy is methodologically unsound. Additionally, the methodologies and sometimes the definitions for the base studies are not necessarily clear meaning the studies cannot be compared much less combined to create something new. Belser et. al. noted this as well saying

“Available national estimates are often disparate, concerning one or two particular forms of forced labour, generally calculated on the basis of secondary information obtained by individual experts or by humanitarian institutions or non-governmental organizations for specific purposes. The underlying concept and methodology of these estimates are in most cases undocumented and in some cases even the date or the time period to which they refer is unclear. They are often based on judgmental considerations or simply derived by applying a fraction to a broader estimate, such as assuming that forced prostitution concerns 10% of the total number of prostitutes in the country.”⁹

As Devereux and Hoddinott also discussed this issue

“The problem...is that a number ‘calcifies’ at each stage-from questionnaire to coding sheet to analysis-until it is one of several hundred numbers contributing to the production

⁸ Margaret Melrose. "Labour Pains: Some Considerations on the Difficulties of Researching Juvenile Prostitution." *International Journal of Social Research Methodology*, 2000: 333-351.

⁹ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 13

of a percentage, in which uncertainty over the accuracy of each individual number is buried forever.”¹⁰

This is only one of the methodological/statistical problems within the field.

According to Elizabeth Kelly, “Future developments in methodology will depend in part on researchers thinking seriously about these issues, experimenting with methods and approaches explicitly designed to counteract barriers to disclosure and discovery.”¹¹

The Estimates

The organizations selected for this paper, are well known in the field for their work to fight modern forms of slavery and were believed to have access to information that could inform researchers creating an estimate. They are classified into three groups: organizations that only publish the number of assisted victims, organizations that publish “second-hand” estimate and organizations that publish original estimates. The organizations that publish numbers on victims assisted include the International Organization for Migration (IOM), and the United Nations Global Initiative to Fight Human Trafficking/United Nations Office on Drugs and Crime (UN.GIFT/UNODC). This group is included in this paper because one cannot create estimates from these numbers, except under complex assumptions, though many try. It is important to understand the limitations and benefits of such data. Organizations that use another organization’s estimates fall into the second-hand estimates. This group includes Anti-Slavery International and Health and Human Services (HHS). The International Organization for Migration (IOM), in some of its material, uses second-hand estimates but for the purposes of this paper a discussion is not included in order to avoid overlapping categories and since such an addition would not enhance the discussion. Finally, organizations that devise their own estimates fall under the original estimate category. This group includes Free the Slaves, The United States Department of State (DOS) and The International Labour Organization (ILO).

¹⁰ Stephen Devereux, and John Hoddinott. *Fieldwork in Developing Countries*. Boulder, CO: Lynne Rienner, 1993. 36

¹¹ Elizabeth Kelly. *Journeys of Jeopardy: A Review of Research on Trafficking in Women and Children in Europe*. London, U.K.: International Organization for Migration, 2002. 13

Table 1: Organization Assisted and Estimated Victims

<u>Assisted Victims</u>	
International Organization for Migration (IOM)	Number of victims assisted- 1999- 28 2000- 591 2001- 818 2002- 1,225 2003- 1,134 2004- 1,780 2005- 2,681 2006- 2,619 2007- 1,805 ¹²
United Nations Global Initiative to Fight Human Trafficking/United Nations Office on Drugs and Crime (UN.GIFT/UNODC)	Number of identified victims 2003- 11,706 2004- 12,122 2005- 13,127 2006- 14,909 ¹³
<u>Second-Hand Estimate</u>	
Anti-Slavery International	2.4 million people have been trafficked (an ILO estimate) ¹⁴¹⁵
Health and Human Services (HHS)	Approximately 600,000 to 800,000 victims annually are trafficked across international borders ¹⁶
<u>Original Estimates</u>	
Kevin Bales	27 million slaves ¹⁷
United States Department of State (DOS)	800,000 men, women, and children are trafficked across international borders each year ¹⁸
International Labour Organization (ILO)	12.3 million in forced labour, 2.45 million people human trafficking ¹⁹

¹² International Organization for Migration. *World Migration 2008: Managing Labour Mobility in the Evolving Global Economy*. Geneva: International Organization for Migration, 2008. 205

¹³ United Nations Office on Drugs and Crime. *Global Report on Trafficking in Persons*. UN.GIFT, UNODC, 2009. 10

¹⁴ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 4 (original).

¹⁵ Anti-Slavery International. *Trafficking: What is Trafficking*.

<http://www.antislavery.org/homepage/antislavery/trafficking.htm#qanda> (accessed February 27, 2009) (cited)

¹⁶ U.S. Department of Health and Human Services Administration for Children and Families. *About Human Trafficking: Overview of Human Trafficking Issue*. <http://www.acf.hhs.gov/trafficking/about/index.html> (accessed February 20, 2009).

¹⁷ Kevin Bales. *Understanding Global Slavery: A Reader*. Berkeley and Los Angeles California: University of California Press, 2005. 103

¹⁸ U.S. Department of State. *Trafficking Victims*. <http://www.state.gov/g/tip/c16467.htm> (accessed February 21, 2009). (Also in 2008 Trafficking in Persons Report)

¹⁹ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 1, 4.

Assisted Victims

IOM and UN.GIFT both focus on trafficking in persons. The only reason this group, which uses numbers based on assisted victims, is worth mentioning in a paper about estimates is to again note that these are not estimates and they cannot be used to estimate the number of victims of human trafficking, without understanding the nature of the likelihood a victim will report their case to either the organization itself or to an organization from which data is collected. They simply tell the number of people assisted and provide no information on the unobserved population. Inferences beyond this, about the nature of actual victims throughout the world, cannot be made because it is unclear if this is a biased sample or not. Should one attempt to create an estimate from this, without having knowledge of the unobserved population's characteristics, it would produce an inaccurate, non-representative estimate. For example, the numbers of victims published by IOM were all assisted by the organization. IOM offices usually are centrally located in major cities. Victims of sexual exploitation are also more often located in major cities because this is where a larger percentage of their clientele are located. Those who are exploited for agricultural labour though, are more likely reside in rural areas where there are few if any IOM offices. The data obtained by IOM then is likely skewed towards those exploited for sexual services. Any generalization or attempt to create an estimate from these numbers then, without knowing the characteristics of the missing population, is problematic primarily because certain groups are likely underrepresented in their data.

In the case of UN.GIFT, they collected information about the number of human trafficking victims assisted in various countries.²⁰ Ten researchers, who were placed in regional offices of the UNODC throughout the world (Abuja, Bangkok, Brasilia, Cairo, Dakar, Mexico City, Nairobi, New Delhi, Pretoria and Tashkent), collected the data. For North America and Europe, officials from the UN affiliated European Institute for Crime Prevention and Control (HEUNI) collected the data. The data was obtained from the governments and non-governmental

²⁰ United Nations Office on Drugs and Crime. *Global Report on Trafficking in Persons*. UN.GIFT, UNODC, 2009. 10

organizations within the researchers' region. Ultimately 155 territories and countries participated in the study and it covers the period between 2003 and 2007.²¹

Since the researchers collected information from multiple sources, and in fact, the sources they used obtained information from multiple sources, it is possible that some victims were counted twice. If a victim received services from multiple organizations, each of the organizations will list this person as a victim. If UN.GIFT collected information from both of these organizations, then the person would be counted twice, or possibly more, depending on how many organizations the victim visited for services. Since both government and non-government organizations were essential in the study, this is absolutely a possibility. This also hinders the creation of an estimate based on this data. As previously noted though people in the field do attempt to use these numbers to create estimates.

While it is certainly necessary to publish the number of assisted victims, if only to let donors know their money is hard at work, it is also important for these organizations to be clear about the limitations of the data. It is important to clearly state that while these are the victims assisted, that estimates suggest there are many more victims (a specific legitimate estimate is the goal) and that other organizations should be careful when citing these numbers. The continued emphasis on the hidden nature of the crime, publication of estimates in addition to the numbers of victims assisted, are essential for the continuation of funding and awareness of this problem. Fortunately, in the case of both IOM and UN.GIFT they clearly state, these are only the number of people assisted and therefore should not be taken as a representative sample.²² Continued emphasis on this in addition to emphasis on more accurate estimates should be helpful.

²¹ United Nations Office on Drugs and Crime. *Global Report on Trafficking in Persons*. UN.GIFT, UNODC, 2009. 8, 14

²² International Organization for Migration. *World Migration 2008: Managing Labour Mobility in the Evolving Global Economy*. Geneva: International Organization for Migration, 2008. 206 and United Nations Office on Drugs and Crime. *Global Report on Trafficking in Persons*. UN.GIFT, UNODC, 2009. 13-15

Second-Hand Estimates

The second group consists of organizations that use “second-hand” estimates. This includes Anti-Slavery International and Health and Human Services. Health and Human Services along with all other US Government Agencies use the estimate produced by the Department of State. This seems logical since the time and resources necessary to produce their own estimate would be great. Also to publish several different estimates through the US Government would lead to confusion.

In general, though, creating an independent estimate is not only difficult but can also be politically charged. Using another organization’s estimates relieves some of these issues. This is particularly problematic though, because citing a source provides more credibility for that source. The original estimate might not be reliable at all, though. Again, Kevin Bales dealt with this issue as discussed above in regards to the 100 million slaves estimate which for a while was highly touted in the field. Perhaps then, one of the main problems in this field is not that there are unreliable estimates, but rather that such estimates are promoted. Methodological “transparency” should not be confused for methodological soundness. In other words, just because there is a methodology does not necessarily mean it is a good one.

Original

The final group of organizations creates their own estimates. Often, these organizations go to great lengths to produce the estimates, and sometimes acknowledge the problems with creating an accurate estimate. Each of these organizations, by creating an estimate, has greatly assisted this field. Despite their contribution, though, it is important to recognise that each methodology has serious limitations or assumptions, which put the estimates into question. Any methodology will have weak points but the point is to minimise these. In this section, the shortcomings of the estimates will be identified and fully explained.

Kevin Bales/Free the Slaves

Kevin Bales, President of Free the Slaves, is one of the most respected experts on modern slavery and human trafficking. Thomas Cushman, the Editor-In-Chief for *The Journal of Human Rights*, dubbed Bales “the world’s leading analyst of modern-day slavery.”²³ Bales believes there are 27 million slaves throughout the world.²⁴ The methodology for this estimate is detailed in *Understanding Global Slavery: A Reader*.

Slavery, according to Bales, is “a social and economic relationship, in which a person is controlled through violence or its threat, paid nothing and economically exploited.”²⁵ He and his assistants used this definition to produce estimates of the number of slaves in 111 countries. This process spanned three years and involved collecting data from reports by U.S. government agencies, the International Labour Organization, experts, NGOs, national governments, the work of academic experts, and press reports. Bales processed this information along with information from case studies, and on the ground observations to establish estimates for these countries. The estimates were “very rough, if informed, guesses.”²⁶ Recognising the potential problems and subjectivity of the original sources, and therefore his estimate, Bales proposed to ask experts in the field to provide their opinion on the estimates. He drew inspiration for this from L.L. Thurstone’s study *Attitudes Can Be Measured*, in which the author was able to create the first known scale for attitudes based on input from experts. The experts in Bales study had personal knowledge of a country, region or industry. Based on the definition above, the experts responded with their opinion about the estimates. They also provided other information for Bales to assist in creating the estimates. Bales adjusted some of the numbers with the information they offered. These country level estimates were compiled together and he estimated there are 27 million slaves worldwide.

²³ Kevin Bales. *Understanding Global Slavery: A Reader*. Berkeley and Los Angeles California: University of California Press, 2005. Back Cover

²⁴ Ibid. 103

²⁵ Ibid. 199.29

²⁶ Ibid. 96-103

Bales indicates that his “own methods of data collection have been simplistic and driven less by epistemological concerns than by practicalities,” and went as far to say that the estimates were a bit “mushy.”²⁷ Bales also clearly states there are validity questions with this study, meaning he might not be measuring what he believes he is measuring. For example, while he may wish to measure incidence of slavery he may be measuring the perception of incidence of slavery.

Despite these acknowledgements, a few problems remain absent from the discussion. First, the sources used to determine the estimates are in question. Bales notes that reports by U.S. Government Agencies which were used in the study, were questionable due to political influences and NGOs are sometimes over-report due to funding pressures. An example of the former would be the tier rankings in the Department of State’s Trafficking in Persons Report are known to be fluid based on the foreign policy interests of the United States and not solely on the status of human trafficking in that country.²⁸ Though there are questions with the data sources, these truly are the only sources generally available for this type of information. Collecting data from more reliable sources, including scholars and experts, hopefully counteracts this. This potential issue is important to recognise but it is difficult to combat.

Second, Bales does not make public how he determined his original estimates. It is clear that he collected information from a variety of sources but then what? Were these estimates an average? He calls them an “educated guess” but this is simply too vague.²⁹ What method or rationale was used to create this guess?

Third, in Appendix 2 of his book *Understanding Global Slavery: A Reader*, Bales lists a wide range of countries with their estimates and categorical groupings. Some surprising

²⁷ Kevin Bales. *Understanding Global Slavery: A Reader*. Berkeley and Los Angeles California: University of California Press, 2005. 102-104

²⁸ Ibid. 96

²⁹ Kevin Bales. *Understanding Global Slavery: A Reader*. Berkeley and Los Angeles California: University of California Press, 2005. 102

countries are missing from the list though. Examples include Angola, Rwanda, Ethiopia, Zimbabwe, Finland, Ireland, Slovenia, Bolivia, Cuba, and Venezuela.³⁰ These countries are not slave free though as noted in various reports and newspaper articles.³¹³²³³ The reader is left wondering if these countries were examined at all. If these countries were not included, then Bales' estimate is biased and does not accurately reflect the true nature and scale of modern slavery throughout the world.

Fourth, Bales does not provide enough information about the "experts." He assured them anonymity, which potentially is not a problem, but Bales does not provide any information about them. For example, how many experts were there? Did the experts examine every country in the study? If not, are the estimates for all of these countries trustworthy? How much did the expert's opinions influence the final estimates? Did any of the experts have an agenda? For example, were these independent experts or did they work for governments? There is also no way of knowing how these experts were found in the first place. This may sound insignificant but it is important to know if these experts were vetted, recommended or even if they were friends. Otherwise, it is unclear if they are trustworthy. To accept his estimates would require trust in Bales' statement that there were experts and that they helped create the estimates and thus the estimates are somewhat reliable. Any information about the experts or how they assisted specifically would be improvement upon the information currently available. The lack of information, though, creates serious doubts about the study.

³⁰ Ibid. 183-186.

³¹ John Whelan, "The 'Happy Hooker' Myth a Far Cry From Reality of Sex Trade," *Independent.ie*, January 3, 2010, <http://www.independent.ie/opinion/analysis/the-happy-hooker-myth-a-far-cry-from-reality-of-sex-trade-1996978.html> (accessed April 20, 2010).

³² U.S. Department of Labor's Bureau of International Labor Affairs, "U.S. Department of Labor's 2008 Findings on the Worst Forms of Child Labor," *United States Department of Labor's Bureau of International Labor Affairs*, 2009, <http://www.dol.gov/ilab/programs/ocft/PDF/2008OCFTreport.pdf> (accessed April 20, 2010).

³³ Martin Patt, Dmitriy Ioselevich, Alex Burka and Arkadiy Abramov, *Human Trafficking & Modern-day Slavery*, 2009, <http://www.gvnet.com/humantrafficking/index.html> (accessed April 20, 2010).

Fifth, by now the measure of slavery is outdated. Though Bales does not indicate what year his measure represents, in a study done later in the book, the independent variables he tests slavery against come from the years 1995 to 1999, and it is likely the estimates of slavery come from around this time. The estimates then, could be at least 15 years old. Bales lists Yugoslavia (here referring to Serbia and Montenegro), which split in 2006. If the estimates come from this period, they likely do not reflect the current situation. Additionally, the information extrapolated from the study cannot be generalised to today. Updating the data is essential to obtain any understanding of slavery as is. It took Bales and his team three years to accomplish this initially. While updating the data is crucial in furthering the understanding of slavery, it is unfortunately not within the scope of this particular study.

Sixth, the measure of slavery is not replicable. Replicability is an essential element of any scientific study; otherwise, the legitimacy of the previous results is in question. The measure is not replicable primarily because Bales does not provide enough information concerning the experts he employed. They were assured anonymity, which is potentially not a problem, but Bales does not tell his readers *anything* about the experts. He does not tell the reader how many experts there were, what countries they verified, how much their input influenced the final product, whether or not they had an agenda, who they worked for, and how their experiences or positions might influence their input. If one wished to replicate the study, these uncertainties would make it impossible to do so. When a study is non-replicable, it puts the results into question. That is true here too.

While the level of detail provided by Bales through his country level estimates is fascinating and monumental in the field, it is not replicable primarily due to the ambiguous creation of the original estimate and the use of non-identified experts. Replicability is an

essential element in any scientific inquiry. If every step taken by Bales were clearly laid out, it still might be that a researcher performing the same study would come up with different figures but the fact that so many steps were left out, means that researcher can never even be certain the same study is being performed.

United States Department of State

The *Trafficking in Persons Report* produced by the United States Department of State is one of the most frequently cited sources on human trafficking. In fact, all branches of the US Government depend on the Department of State's estimate when attempting to quantify severe forms of human trafficking. Additionally the estimate has also been used in documents produced by the International Organization for Migration, Polaris Project, Free the Slaves, and University of Pennsylvania School of Social Work.³⁴ The Department of State estimates that 800,000 men, women, and children are trafficked across international borders each year.³⁵

Their estimate refers to the number of people in severe forms of trafficking. This is

“ (A) sex trafficking in which a commercial sex act is induced by force, fraud, or coercion, or in which the person induced to perform such act has not attained 18 years of age; or

(B) the recruitment, harboring, transportation, provision, or obtaining of a person for labour or services, through the use of force, fraud, or coercion for the purpose of subjection to involuntary servitude, peonage, debt bondage, or slavery.”³⁶

Though the Department of State provides nearly no details concerning its methodology, a study by Caliber for the United States Department of Justice offers more insight. According to the study, the *Trafficking in Persons Report* published the following figures in the following years:

³⁴ Heather J Clawson, Mary Layne, and Kevonne Small. *Estimating Human Trafficking into the United States: Development of a Methodology*. Submitted to the US Department of Justice, Washington D.C.: Caliber, an ICF International Company, 2006. 6

³⁵ U.S. Department of State. *Trafficking Victims*. <http://www.state.gov/g/tip/c16467.htm> (accessed February 21, 2009). (Also in 2008 Trafficking in Persons Report)

³⁶ 106th Congress. "Victims of Trafficking and Violence Protection Act of 2000." Washington, D.C.: United States Congress, October 28, 2000.

Table 2: *Trafficking in Persons Report Estimates*

Year	2001	2002	2003	2004
Estimate	700,000	700,000	800,000-900,000	800,000-900,000

Heather J Clawson, Mary Layne, and Kevonne Small. *Estimating Human Trafficking into the United States: Development of a Methodology*. Submitted to the US Department of Justice, Washington D.C.: Caliber, an ICF International Company, 2006. 4

These were the sources used in the creation of the estimate:

Table 3: Sources for Department of State's Estimate

Year	Interview	Document Review	Focus Group	Panel Discussion	E-mail	ACCESS Database	Regional Site Visits
2001	X	X	X				
2002	X	X	X	X	X		
2003	X	X	X	X	X	X	X
2004	X	X			X	X	X

Heather J Clawson, Mary Layne, and Kevonne Small. *Estimating Human Trafficking into the United States: Development of a Methodology*. Submitted to the US Department of Justice, Washington D.C.: Caliber, an ICF International Company, 2006. 4

Since 2001, 186 embassies throughout the world assisted in the creation of the estimate by providing information on human trafficking. The interviews performed between 2001 and 2004, consisted of discussions with host governments, immigration officials, police, NGOs, victims and journalists. The documents from the same period included NGO reports, press releases and government documents. Documents from regional bureaus, the intelligence community, the Department of State's Bureau of International Narcotics and Law Enforcement Affairs, the Bureau of Democracy, Human Rights and Labour, the Office of the Legal Advisor, UNICEF, Human Rights Watch, Amnesty International, the Protection Project, the media, the United Nations High Commissioner for Refugees, and the International Organization for Migration were also influential in the researcher's estimates. The Government Accountability Office (GAO) notes that articles in various languages were also used for the estimate. The Foreign Broadcasting Information Service translated these documents into English.³⁷

³⁷ U.S. Government Accountability Office. *Human Trafficking: Better Data, Strategy, Reporting Needed to Enhance U.S. Antitrafficking Efforts Abroad*. Report to the Chairman, Committee on the Judiciary and the Chairman, Committee on

The GAO claims that the estimate produced by the Department of State is formed through a Markov Chain Monte Carlo method (MCMC) with Bayesian Inferences.³⁸ A Markov Chain Monte Carlo Method refers to “a tool or algorithm for sampling from probability distributions based on constructing a Markov Chain. The state of the chain after many steps is then used as a sample from the desired distribution.”³⁹ In basic terms the Monte Carlo Methodology is a set of methods that are probability based. Though one event might not be predictable, the average over many events is certain through the normal probability distribution, which is explained below. There are many different techniques but in most cases, the beginning stage is arbitrary. Small changes are made at random, in this case through MCMC, and those that “improve the solution” stay while those that make it worse are thrown-out with a probability based on the degree to which the change makes the solution worse. This will continue until a detailed balance is met.⁴⁰ A Markov Chain refers to a collection of data, in which, the future is dependent on the present but independent of the past.⁴¹

If the data is believed to have a normal distribution then the following is known:

Graph 1: Normal Probability Distribution

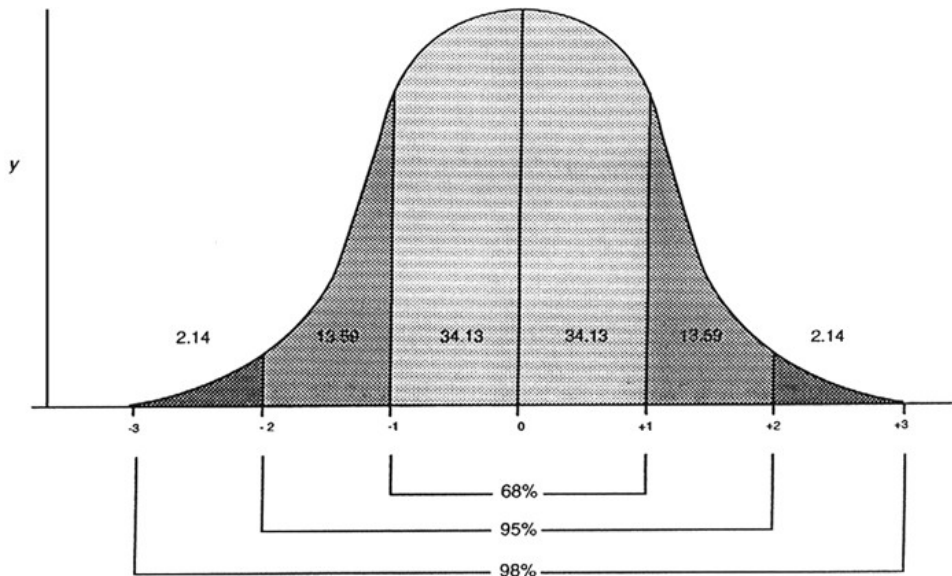
International Relations, House of Representatives, Washington, D.C: United States Government Accountability Office, 2006. 5, 44

³⁸ Ibid. 45

³⁹ Fred W. Allendorf, and Gordon Luikart. *Conservation and the Genetics of Populations*. Malden, MA: Blackwell Publishing, 2007. 535

⁴⁰ Chjan Lim, and Joseph Nebus. *Vorticity, Statistical Mechanics, and Monte Carlo Simulation*. New York: Springer, 2007. 56

⁴¹ E. W. Weisstein, (2009). *CRC Encyclopedia of Mathematics Third Edition*. Boca Raton, FL: Chapman & Hall/CRC. 2437



Godden, Kurt. *Elo to Glicko: Your Rating Explained*. May 11, 2008. <http://blog.chess.com/kurtgodden/elo-to-glicko-your-rating-explained> (accessed February 2, 2010).

The positive and negative numbers in the diagram above refer to standard deviations, or standard error. Each standard deviation is the same length apart and this value is obtained through the statistical output of the test being performed. In other words, approximately 68% of the observations fall within \pm one standard deviation to the left and right, leading to a 68% confidence interval, approximately 95% fall within two standard deviations and approximately 98% fall within three. Thus, once the standard deviation is known, a range of values for the desired confidence level can be determined. For example if a researcher chooses a 95% confidence level, 95 out of 100 tests will produce a number within the range created by two standard deviations. This range, for example, could be the estimate of 600,000-800,000 victims of severe forms of human trafficking worldwide, but that is not certain.

Bayesian Inference allows a slightly different interpretation; the normal confidence intervals above tell a person if they were to perform the test 100 times, how many times the test results would fall in the range that person choose. One cannot say that any particular event has a certain percentage chance of occurring. It either does occur or it does not and if the confidence interval is set at 95%, then 95 times out of 100 trials the value obtained will fall in that range.

Bayesian Inference though is “a procedure of statistical inference in which observed data are interpreted not as frequencies or proportions,” as in the case of confidence intervals, “but rather are used to compute the probability that a hypothesis is true, given what was observed.”⁴² The Bayesian Inference part is able to say what the probability is that the event will occur. The Bayesian Inference also allows prior data to be used in calculating what is called the posterior probability. This is effectively the new probability that an event is true based on new information.⁴³

Many have explained this method in terms of a robot. Imagine a robot is in a confined space and there is also a hill within this confined space. The location of the hill is not known. The robot takes steps of different direction and length. Each future step depends in part on the current location of the robot but not the previous location of the robot. After many steps, the robot will visit almost if not every spot within the space. If the robot is directed to take all steps that would lead it uphill and to only take downhill steps in proportion to a probability based on the reduction of elevation (this refers to where the addition of the data that make it worse are thrown-out with a probability based on the degree to which the change makes the solution worse), the robot is likely to spend more time on the hill than elsewhere in the sampling area. From this the probability that this area of the sampling frame is the hill is determinable.⁴⁴

Monte Carlo methods were used to produce estimates in a related study of trafficking into the United States. The authors of that study said that, “Monte Carlo simulation is categorized as a sampling method because estimates are generated from probability distributions (e.g., a normal distribution, or bell-shaped curve: height follows a normal distribution) to simulate the process of

⁴² Fred W. Allendorf, and Gordon Luikart. *Conservation and the Genetics of Populations*. Malden, MA: Blackwell Publishing, 2007. 527

⁴³ E. W. Weisstein, (2009). *CRC Encyclopedia of Mathematics Third Edition*. Boca Raton, FL: Chapman & Hall/CRC. 563

⁴⁴ Fred W. Allendorf, and Gordon Luikart. *Conservation and the Genetics of Populations*. Malden, MA: Blackwell Publishing, 2007. 565-566

sampling from an actual population.”⁴⁵ In creating estimates for the *Trafficking in Person’s Report* the researcher used “plausible values for unknown information, the technique (MCMC) replaces missing data under a wide range of conditions to reflect uncertainty in the open source information regarding the type of trafficking, age group, gender, country of origin and destination.”⁴⁶ The plausible values appear to come from “aggregate estimates” of those victims who are reported and not reported by organizations including International Organizations, Governments and NGOs.⁴⁷

The Department of State does not provide their methodology so it is difficult to critique. There are some common complaints though both about the MCMC and Bayesian Inferences. The main problem with Markov Chain Monte Carlo methods is in the process. Usually the first thousand steps in the process or so are thrown out. This is known as the “burn-in” and is used to ensure there is not a bias in the result based on the starting point. It is hard to determine though where independence from the starting point begins. Additionally, the simulation programs are complex and difficult to write in computer code. This means that there tend to be a lot of errors and these errors are difficult to detect. The main problem with Bayesian techniques though, is that they can be heavily influenced by information that was obtained prior and are therefore less objective than more traditional methods. If different researchers begin with different prior information, they are likely to obtain different results.⁴⁸ Usually the prior information does not dramatically influence the posterior though, particularly when there is a lot of data.

⁴⁵ Heather J Clawson, Mary Layne, and Kevonne Small. *Estimating Human Trafficking into the United States: Development of a Methodology*. Submitted to the US Department of Justice, Washington D.C.: Caliber, an ICF International Company, 2006. 19

⁴⁶ U.S. Government Accountability Office. *Human Trafficking: Better Data, Strategy, Reporting Needed to Enhance U.S. Antitrafficking Efforts Abroad*. Report to the Chairman, Committee on the Judiciary and the Chairman, Committee on International Relations, House of Representatives, Washington, D.C: United States Government Accountability Office, 2006. 45

⁴⁷ Ibid. 13

⁴⁸ Fred W. Allendorf, and Gordon Luikart. *Conservation and the Genetics of Populations*. Malden, MA: Blackwell Publishing, 2007. 564

In addition to the problems with the model type, the United States GAO suggests there are many questions, which are not addressed in the creation of the estimate in the 2003 *Trafficking in Persons Report*. For example, one person within the Department of State created the estimates and did not record all steps taken to produce it. This is in part because the agency, which produces the estimate, is a member of the intelligence community and therefore has not made the methodology readily available. For example, it is unclear how the Monte Carlo methodology was carried out so any critique or explanation of the method has to remain general. More information is necessary to replicate the study, such an explanation of how exactly the Markov Chain Monte Carlo method was used to produce this estimate, but the Department of State is not likely to provide that information. This estimate itself is likely not replicable and thus its reliability is in question.⁴⁹

The GAO also notes that much of the country level data, that could be used in the MCMC to create the estimate, are not comparable, reliable or even available. These estimates are not reliable alone or even comparable because they are measuring slightly different interpretations or definitions, sources of data, processes for validation and methodologies. The methodologies for these base sources are also not clearly detailed if they are detailed at all. Additionally, there is a simple lack of information about the scale of trafficking at the country level. The authors of the GAO report believe this is one factor, which frustrates attempts to create international estimates.⁵⁰

Additionally the estimates only examine cross border trafficking. The authors of the GAO report note that this could be a problem in countries such as India, where there are wide reports of forced labour and domestic trafficking. While the United States does deem involuntary

⁴⁹ U.S. Government Accountability Office. *Human Trafficking: Better Data, Strategy, Reporting Needed to Enhance U.S. Antitrafficking Efforts Abroad*. Report to the Chairman, Committee on the Judiciary and the Chairman, Committee on International Relations, House of Representatives, Washington, D.C: United States Government Accountability Office, 2006. 10, 13

⁵⁰ U.S. Government Accountability Office. *Human Trafficking: Better Data, Strategy, Reporting Needed to Enhance U.S. Antitrafficking Efforts Abroad*. Report to the Chairman, Committee on the Judiciary and the Chairman, Committee on International Relations, House of Representatives, Washington, D.C: United States Government Accountability Office, 2006. 10, 13

servitude as a form of severe trafficking, it is not included in the international estimate since it only examines cases that cross borders. Additionally, many countries may be overlooking internal trafficking in their countries since it is not in their legislation. A woman who is forced to sell sex by a pimp in her own country might not be considered a victim of human trafficking since she is a citizen of that country. If the same situation were occurring to a foreign national though, it may be considered a severe form of human trafficking. Furthermore, the estimates only provide information for a period of one year. In other words, this information cannot be used to determine if the problem is increasing, decreasing or staying the same. The estimate then is not helpful for creating effective policies.⁵¹

International Labour Organization

The ILO's estimate is detailed in a study written by Belser, de Cock and Mehran. The International Labour Organization's (ILO) international estimate focuses on forced labour. Their definition emerges from ILO Conventions 29 and 105 and proposes that compulsory or forced labour is "all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily," excluding military service.⁵² ILO Convention 105 states that forced labour cannot be used for political education, economic development, discrimination, or for labour discipline such as punishment for striking.⁵³

The authors recognise it is impossible to count every victim of forced labour. Usually the remedy would be to take a random sample and generalise to the whole population. As discussed previously, this is not possible in the case of modern forms of slavery, including forced labour, since it is a hidden population.⁵⁴ Instead, the authors choose to use another sampling technique known as the Capture-Recapture method. Originally, this method was used to estimate animal

⁵¹ Ibid. 13-14

⁵² International Labour Organization. "C29 Forced Labour Convention, 1930." Geneva, 1930.

⁵³ International Labour Organization. "C105 Abolition of Forced Labour Convention, 1957." Geneva, 1957.

⁵⁴ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 15

populations and has since been expanded to estimate hard to reach human populations such as the homeless.⁵⁵ This process uses the number of cases collected by two independent teams, as well as the amount of overlap, to produce an estimate of total cases.

To produce their estimate, the authors follow what they call a “two-step process,” though it is perhaps easier to understand in a three-step format. First, they estimate the number of reported cases of forced labour from 1995-2004 through the Capture-Recapture Methodology. Second, they estimate the number of reported victims during this period. Third, they use some assumptions about the duration of forced labour and the likelihood one will report a case of forced labour to estimate the number of victims at any one time (both reported and unreported).⁵⁶

Data Collection

To determine the estimate the researchers first needed to collect data. Two research teams of six people each were provided the same materials and training for this project. To maintain independence the teams were placed in separate parts of the ILO building. Sharing of information and methods was prohibited because this could bias the collection process leading to more overlap in data than there should be.⁵⁷

Reported cases of forced labour were determined by the following criteria:

- Recognise it as a type of forced labour (a)
- Indicate the number of people involved in the incident (x)
- Occur within an identifiable geographic region (h),
- Occur within a certain identifiable time-period or on a certain date (t).⁵⁸

Each number the researchers found was recorded in a database and a hard copy was kept and catalogued. Sources the researchers consulted included ILO, international organizations,

⁵⁵ Malcolm Williams, and Brian Cheal. "Can We Measure Homelessness? A Critical Evaluation of the Method of "Capture-Recapture". *International Journal of Social Research Methodology*, 2002: 313-331.

⁵⁶ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 14

⁵⁷ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 24

⁵⁸ Ibid. 14

governments, academics, trade unions, local NGOs, international NGOs, and media.⁵⁹ Depending on the source, resources in eleven or seven different languages were examined for the study.⁶⁰ Throughout the study, the researchers collected over 5,000 pieces of data, or cases, on forced labour with both teams collecting about the same amount of cases.⁶² There was some variation in the regions from which the researchers' sources came.

Validation of Data

Next, the researchers proceeded to the validation process. This was a four-step process. The first step was to determine that the cases the researchers collected actually represented cases of forced labour as defined by ILO Conventions 29 and 105. Three basic guidelines were used to determine this.

- the people had entered this work against their own will
- the people involved are kept against their will (either physically or through confiscation of documentation).
- they could not leave without great risk.

If any of these conditions were not met, the case was discarded.⁶³

The second step in the validation process was to ensure that the incidences occurred between 1995 and 2004. It is possible that while a case was reported about during this time that it in fact did not occur during this time. If it did not occur during this period, the case was thrown out.⁶⁴

The third step was to ensure the reliability of the data. The reliability of the data was determined by the following two criteria:

⁵⁹ Ibid. 25

⁶⁰ U.S. Government Accountability Office. *Human Trafficking: Better Data, Strategy, Reporting Needed to Enhance U.S. Antitrafficking Efforts Abroad*. Report to the Chairman, Committee on the Judiciary and the Chairman, Committee on International Relations, House of Representatives, Washington, D.C: United States Government Accountability Office, 2006. 45

⁶¹ International Labour Conference. *A Global Alliance Against Force Labour*. Global Report under the Follow-up to the ILO Declaration on Fundamental Principles and Rights at Work, Geneva: International Labour Organization, 2005. 9

⁶² Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 26

⁶³ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 27, 29

⁶⁴ Ibid. 29

- it had to be a primary source
- the source had to be credible

The latter was determined by whether it was produced by a known organization or author. If the estimate was not linked with a specific author or organization, it was discarded.⁶⁵

The last part of the validation process was to look for duplicates within the teams' data. Once the validation process was complete, those sources that remained were grouped into three categories. The first category was reported cases, which had been validated. This group was tested using the Capture-Recapture methodology to estimate the number of reported cases. The other two data groups, global estimates and other forms of data were used as references for the final estimate. Nearly a third of all cases were discarded through this process.⁶⁶ Once the validation process was complete, the authors were able to begin creating their estimate.

First-Step: Estimation of Cases

The Capture-Recapture Method uses data from overlapping cases (two or more groups of data) to estimate the number of cases that are unobserved.⁶⁷ To just add the two groups together would lead to underestimation because it is likely that there are cases not contained in any of the groups. When researchers use the Capture-Recapture Method, they will normally use the Lincoln-Peterson method. The Lincoln-Peterson method is simply

$$N = \frac{A * B}{C}$$

where N is the estimated number of the population overall, A is the number of cases found by Team One, B is the number of cases found by Team Two and C is the number of overlapping cases known as the recaptured cases. A more detailed discussion of how this method works is outlined in Appendix A.

⁶⁵ Ibid. 28-29

⁶⁶ Ibid. 31

⁶⁷ D. McCarty, E. Tull, C. Moy, C. Kwoh, R. Laporte. Ascertainment corrected rates: applications of Capture-Recapture methods. *International Journal of Epidemiology* 1993; 22:559-565

The authors used a slightly different approach for this study. The data was separated into different strata. These strata were based on region and type of forced labour; for example, forced commercial sex in industrialised countries.⁶⁸ The exact formula the authors used then for the Capture-Recapture Method was the following:

$$N = \frac{(n_1 + 1)(n_2 + 1) - 1}{(n_{12} + 1)}$$

This is the same as the general Capture-Recapture methodology but allows for the possibility that there are no recaptured cases within particular strata.⁶⁹ The authors use this formulation with the validated cases to produce an estimate of *reported* cases within the strata.

Second-Step: Estimating Reported Victims

Once the number of reported cases was estimated the authors proceeded to estimate the number of reported victims. The first step here would be to determine the average number of victims. This could be done by

$$\frac{X}{n}$$

where

$$\begin{aligned} X &= x_1 + x_2 - x_{12} \\ n &= n_1 + n_2 - n_{12} \end{aligned}$$

or

$$\frac{(x_1 + x_2 - x_{12})}{(n_1 + n_2 - n_{12})} = \text{average}$$

⁶⁸ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 18

⁶⁹ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 20

Here X is for total victims, which is found by adding the victims from Team One x_1 and Two x_2 while subtracting the number of victims that are common to both x_{12} (any time there is a subscript of 12 it means the overlapping cases of Team One and Two). The denominator n is simply the number of cases found which comes from the addition of cases Team One found and the cases Team Two found, while subtracting the number of common cases. It is total victims discovered divided by total cases discovered. This average could then be multiplied to the number of estimated cases as determined by the Capture-Recapture methodology above to create an estimate of the total victims from 1995-2004.⁷⁰

The authors recognised though, that some cases had a higher probability of being captured. As such, they choose to take a slightly different approach and estimated the number of reported victims based on known probabilities that the case would be discovered. This allows for the possibility that some cases are less likely to be found than others. This means that while the probabilities within the strata must remain the same, those between different strata can be different. The probabilities refer to the probability that Team One will capture the incidence and if not then Team Two will capture it. This is discussed in more detail below.

In basic terms, it is important to remember that the total number of victims comes from the addition of all the victims together, both those that are captured and those that are not captured in the study

$$T = X_1 + \dots + X_i + \dots + X_N$$

⁷⁰ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 18-19

Here i is a reported case of forced labour.⁷¹ It can take any value depending on which specific case it is representing. X is the number of victims in that particular case, which proceeds to N , or the total number of reported cases throughout the world.

Since information is only available for the cases captured though, this formulation must be adjusted so that

$$T = \left(\frac{x_1}{\pi_1} \right) + \dots + \left(\frac{x_i}{\pi_i} \right) + \dots + \left(\frac{x_n}{\pi_n} \right)$$

Again here

$$n = n_1 + n_2 - n_{12}$$
⁷²

or the total number of cases captured in the study. Small x stands for victims in each of the *captured* cases in the sample and π represents the probability of capture, which again refers to the probability that either Team One or Team Two will capture a case of forced labour.⁷³

Mathematically this can be written as

$$\pi_i = \frac{n}{N}$$

where again n is the number of cases captured by Team One and Team Two without overlap, divided by the estimated number of cases throughout the world. A more detailed discussion of this can be found in Appendix B.

⁷¹ Ibid. 19

⁷² Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 19

⁷³ Ibid.

Remember this equation is strata specific and will change based on what strata is being examined. Once the probability is found, the next step is to add this probability back into the equation⁷⁴

$$T = \left(\frac{x_1}{n/N} \right) + \dots + \left(\frac{x_i}{n/N} \right) + \dots + \left(\frac{x_n}{n/N} \right)$$

Since the denominator within the strata is common, these can be added together to get the total for the strata

$$T = \frac{x}{n/N}$$

x is for total number of victims in the cases that were captured. This can be rearranged to show that

$$T = \frac{x}{n} N$$

Thus, the total estimate for victims is the total estimated number of cases (N) times the average number of victims per case examined. This is exactly the same outcome as before but allows for different probabilities within different strata. These strata, based on region and type of forced labour, can then be added together to create an estimate of all people in forced labour between 1995 and 2004.

By using this seemingly more round about method, the authors see two advantages. The first is that the method can be generalised to things other than victims so that the same method can be used for different estimates. Another advantage the authors note is what they call

⁷⁴ Ibid.

“computational generality.”⁷⁵ This suggests that when the probabilities of selection are calculated and then applied to the reported cases within the sample or strata, calculating the estimates will be based on a weighted sum (based on the averages) of the cases reported (N). The average number of victims will change based on what aspect of forced labour is being examined but N will not.⁷⁶

Step Three: Estimate of Victims in Forced Labour at Any Time

The next step is to get from the estimated reported victims in the period (also known as T_{flow}) to the estimate of victims throughout the world at any one time (also known as T_{stock}), both reported and unreported. The estimate produced from the above data would be the number of reported victims of forced labour between 1995-2004. This is known as the flow estimate, T_{flow} . What is important, though, is the stock estimate T_{stock} . This is the number of people in forced labour at any one time, both those who reported and those who did not. To find this, it is necessary to take into account the number of people who have entered and the number of people who have left forced labour during that period, since not everyone will stay in for the full duration of the observation period, and the likelihood that someone will report their case. To begin, the authors used the following to show the relationship between stock and flow of reported cases of forced labour⁷⁷:

$$\begin{aligned} &\text{Total number of victims at anytime between 1995 and 2004} = \\ &\text{Total number of victims in forced labor 1995 - 2004} * \\ &\text{Average period in forced labor between 1995 and 2004 as a fraction of 10 years} \end{aligned}$$

The authors note that the duration a person remains in forced labour varies widely and seems to be based in part on the type of forced labour and location. It can last from several hours

⁷⁵ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 20

⁷⁶ Ibid. 20

⁷⁷ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 21

to a whole lifetime.⁷⁸ The total number of *reported* cases at any one time can be represented by the following equation

$$T_{stock} = \sum_h T_{flow_h} \mu_h$$

This is where T_{stock} represents the total number of reported victims at any one time between 1995 and 2004, which is found by adding (Σ) all separate strata together. Within each strata, there is an estimated number of victims throughout the period of observation, again T_{flow} . This is multiplied by μ , which represents the average time a person spends in forced labour as a fraction of 10 years (since this is the examination period).⁷⁹ Each strata will have a different T_{flow} and μ this is why the summation sign is important. This formula only indicates the number of *reported* cases of forced labour at any time.

What is important to know though, is an estimate of the reported and unreported cases of forced labour at any one time. There is no direct way to estimate the number of unreported cases so an indirect method has to be used. In attempting to determine the number of unreported victims, it is important to remember a basic principle⁸⁰

$$\text{Total Cases Forced Labor} = \text{Reported Cases} + \text{Unreported Cases}$$

Assuming that r_h is the ratio of reported to unreported cases of forced labour in strata h , an estimate for the number of unreported cases can be determined and added to the reported cases to create an estimate of the stock of people in forced labour at any one time, both those that are reported and those that are not. The equation above can be rewritten as⁸¹

⁷⁸ Ibid. 21

⁷⁹ Ibid. 21

⁸⁰ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 22.

⁸¹ Ibid. 22

$$T_{stock} = \sum_h T_{flow_h} \mu_h + \sum_h T_{flow_h} \frac{u_h}{r_h}$$

$$T_{stock} = \sum_h T_{flow_h} \mu_h \left(1 + \frac{1}{r_h} \right)$$

$$T_{stock} = \sum_h T_{flow_h} \frac{\mu_h}{p_h}$$

Here the p_h represents the proportion of cases that are reported in strata h compared to the total.⁸²

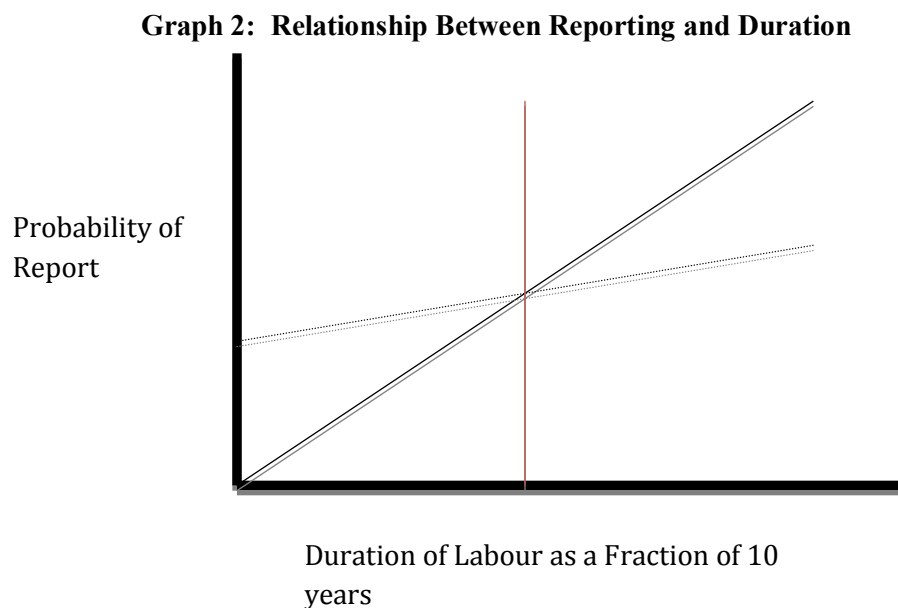
This is really just a rearrangement. The first equation indicates that the total stock is equal to reported cases and unreported cases. How to determine the number of reported cases is detailed above but to find unreported cases the same equation for reported cases can be used and then divided the proportion of reported to unreported cases. Continuing the process of mathematical simplification, it becomes apparent that the total stock is equal to the sum of all total flows multiplied by the average duration in forced labour divided by the proportion of reported cases to total cases as represented by p_h . To complete this equation it is essential to know the average duration one stays in forced labour as well as the total strata's proportion of reported cases.⁸³

This is not easy information to obtain but the authors think that this proportion on average is close to 1. This is because of their belief concerning the relationship between the number of reported cases and the duration of forced labour situations. The authors note there have been several studies suggesting that the average duration of commercial sexual exploitation is between 1 to 2 years. Additionally, they note that since this type of exploitation normally occurs as the result of some form of human trafficking and because both the trafficking and the sexual nature of work are illicit, one would expect fewer reported cases. From this they determine that with shorter periods in forced labour, there should be fewer reported cases. They note that the opposite is true of bonded labour. Exploitation through labour (non-sexual) tends to

⁸² Ibid. 22

⁸³ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 22

last a longer time, possibly generations. Since agriculture and incurring debts are legal, the authors assume this means that the proportion of reported cases would be higher.⁸⁴ Due to this, the authors believe that long durations in forced labour will be associated with a higher probability that cases will be reported. The relationship can be seen in the following graph⁸⁵:



⁸⁴ Ibid. 21-23

⁸⁵ Ibid. 24

Here, the dotted black line represents the actual proportion and the solid black line represents a fraction, and thus the slope, which equals 1. The red line represents the average ratio over all strata. If the assumption that $\frac{u_h}{p_h} = 1$ is valid then the following should be expected:⁸⁶

$$T_{stock} = \sum_h T_{flow_h}$$

Though at any one point the authors believe this ratio might not be equal to one, the average of these ratios is likely close to one. This means that the flow estimate is upon approximation equal to the stock estimate.⁸⁷

A Word of Caution

The authors do note that there are errors, which should be taken into account. The first type of error is sampling errors. This refers to the fact that only some of the cases of reported forced labour were examined for this study (it would be difficult to examine much less find every case in the world). While Capture-Recapture methods are supposed to help estimate the missing portion of this data, the authors note that sampling errors come from the fact that they are attempting to generalise from only a portion of the total population of interest. Since this study used two samples, not only were they able to obtain the global estimate, but they were able to determine a sampling error as well. The sampling error is more often known as the standard error and shows the value of one standard deviation as mentioned before in the analysis of the Department of States's estimate. The authors estimated that there are 12.3 million people in forced labour throughout the world and that the standard error for this study is 2.5 million people. In other words, there is "high likelihood" that the number of persons in forced labour throughout the world lies between 9.8 million and 14.8 million.⁸⁸ The authors determined the relative

⁸⁶ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 23

⁸⁷ Ibid. 24

⁸⁸ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 32

standard error, which is a calculation of the standard error compared to the estimate they came up with lies at 20%.

$$\frac{2.5 \text{ million}}{12.3 \text{ million}} \approx .20$$

The authors admit this is quite large. The number of people in forced labour throughout the world is most likely to be within one standard deviation of the estimate produced; in other words $12,300,000 \pm 2,500,000$. This leads to the range given previously.⁸⁹ There is a 68% confidence level in this interval meaning if the test were performed 100 times, 68 of those times the true value will lie within this range.

The second type of error, coverage errors, deals with the fact that a sample is unobtainable from cases of forced labour that were not reported. The authors claim that “(a)n effort has been made to account for this incomplete coverage by exploiting the relationship that exists between the different forms of forced labour and their likely propensity of non-reporting.”⁹⁰ The authors did note that it would be hard to estimate the coverage area so they compared international estimates with estimates that they found in other sources. One example is Kevin Bales, who came up with the estimate of 27.9 million slaves in his 1999 version of *Disposable People*. It appears that most of their estimates were nearly the same except in the case of Asia where Bales estimate was much higher than the ILO. This is probably due to methodology and definition differences between the two.⁹¹

Problems with this Methodology

While this study is innovative in its use of the Capture-Recapture methodology, there are some serious issues, which the authors did not address. These issues can be grouped into two

⁸⁹ Ibid.

⁹⁰ Ibid.

⁹¹ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 34

basic categories, problems with the Capture-Recapture method itself, and problems with the study as performed.

There are three main assumptions with the Capture-Recapture method. While the authors have attempted to address some of these issues, there are still some shortcomings. The first assumption is that the sets are independent of each other. Thus, Team One and Team Two's captured cases are independent and the probability that Team One captures a certain case is the same probability as Team Two capturing that case.⁹² The authors of the study attempted to control for this by requiring that teams did not share information with each other. The authors state that the researchers were given the same training, but could there be characteristics of the training or the researchers themselves that might have compromised this independence? For example, was there training on potential sources or where to look, and if so did this affect how the research was conducted? Perhaps most important though, were the researchers staff members of the ILO? If so, can independence be assured in their results? Could there be a bias due to organizational culture? It is possible that if these people were staff of the ILO that the organization's culture could lead to the use of preferred sources of information for the organization, which would lead to bias within the study. Any previous experience in this type of research also could lead to similar biases and thus increase unnatural overlap. While this may not have been an issue, it is important to recognise as a potential flaw.

The second assumption is that the probability of being captured is equal for all cases.⁹³ This means that any particular reported case of forced labour has the same chance of being captured by the researchers as any other. There are two main problems with this assumption in this study. The first problem is that it possible for a case to be so hidden that it would not be found but would have been reported. Additionally, it is more likely that cases with fewer victims

⁹² Laure Papoz, Beverley Balkau, and Joseph Lellouch. "Case Counting in Epidemiology: Limitations of Methods Based on Multiple Data Sources." *International Journal of Epidemiology*, 1996: 474-478. 475

⁹³ Laure Papoz, Beverley Balkau, and Joseph Lellouch. "Case Counting in Epidemiology: Limitations of Methods Based on Multiple Data Sources." *International Journal of Epidemiology*, 1996: 474-478. 475

will not be reported as widespread as those with more victims. In other words, the larger cases are more likely to be reported in multiple sources and thus are more likely to be found.

Corruption could also lead to a case being reported but not listed in records or not being published in the news though they were reported. This aspect is not addressed in the study.

The third assumption is that the population is closed, meaning no one comes or goes from the population.⁹⁴ This is an unreasonable assumption within this study but the authors have tried to eliminate this problem by accounting for the average time one stays in forced labour as a proportion of the examination period. The assumption they make about this relationship is problematic, but this issue will be discussed later in the context of reported to unreported cases of forced labour.

If any of these three assumptions does not hold then the results obtained cannot be trusted as representative of the population as a whole.⁹⁵ With multiple if not all of these in question, it is hard to accept that the results obtained are actually accurate. The problem is that the mean and standard deviations will be inaccurate when the underlying assumptions are not fulfilled and thus the estimate will be biased.⁹⁶ It must be noted though that most statistical analysis are based on unrealistic assumptions. This is the only way the tests can be performed in reality. Here the authors attempted to control for some of these problems and that is more than most studies do.

The second set of problems is with the study as detailed. The first of these is that there is reason to believe that the population of unreported cases might be fundamentally different from those that are reported, or that cases which are discovered are fundamentally different from reported cases that are not discovered, and there is no way to test this. Major cases of forced labour are likely to be disproportionately discovered and reported as compared to cases of one or

⁹⁴ Ibid.

⁹⁵ Kate Tilling. "Capture-Recapture Methods-Useful or Misleading?" *International Journal of Epidemiology*, 2001: 12-14.

⁹⁶ Laure Papoz, Beverley Balkau, and Joseph Lellouch. "Case Counting in Epidemiology: Limitations of Methods Based on Multiple Data Sources." *International Journal of Epidemiology*, 1996: 474-478. 477

two victims. Additionally the GAO claims that materials in 11 different languages were examined. This means that sources in other languages were ignored. It is possible that forced labour in a certain region again is fundamentally different than in another region but since no one spoke that language they were not discovered. As such, the data on cases that were discovered cannot be generalised to cases that were not, especially when estimating victims.

The second problem is that there are widely divergent observations in the categories the researchers examined. Here were their observations:

Table 4: Captures by Team One and Team Two

Region	Team One	Team Two
Asia and the Pacific	710	1,049
Industrialised Countries	820	402
Latin America and the Caribbean	290	578
Middle East and North Africa	200	110
Sub-Saharan Africa	298	224
Transition Economies	230	140
World	6	54
Total	2,554	2,557

Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 26

For example, Team One observed 710 cases in Asia and the Pacific while Team Two observed 1,049. In the Industrialised Countries, Team One captured 820 cases and Team Two captured 402. Several of the regions follow a similar disproportionate pattern. While there should be some variation between teams, having twice as many cases in a region as another team suggests something is wrong. There is some fundamental bias in the data collection technique. This could be because of the different languages the researchers spoke or it could be because of the researcher's country of origin or regional interest. There is too much deviation in the data here

between teams and this really puts the results of the study into question. Without the unbiased sample, the Capture-Recapture method cannot be used effectively.

The third problem is with the assumption that $\frac{u_h}{p_h} = 1$. This is saying that the duration one stays in forced labour, as a fraction of 10 years, is on average proportional to their likelihood of reporting that case. Again, this is based on the idea that while those in situations of sexualized forms of force labor are there for shorter periods of time, that they are also less likely to report cases of exploitation because of the illicit nature of it. Those who are in forced agricultural labour, though, are more likely to report their case because the nature of the work and the nature of the debt are not illegal, though their treatment is. The authors then argue that due to this trend the average of these will be nearly equal to one. There is one main problem with this assumption, mainly contradictory evidence. To illustrate this problem one needs to look at the data. The problem is no other organization really focuses on forced labour but rather focuses on human trafficking. In other words, to fully show this contradiction, it is necessary to look at what the ILO says about human trafficking and compare it to what others are saying about human trafficking. While it would be more ideal to look at what other organizations are saying about forced labour and to compare that to the ILO's statement that is not possible.

To explain this problem then, one must look at the data from the ILO on human trafficking, which they see as a subset of forced labour. Nothing the ILO says nor that is stated elsewhere in the literature gives reason to believe that the ILO's assertion about forced labour as a whole, i.e. that those who are victims of economic exploitation are more likely to report their case than those in forced sexual exploitation, would not also apply to cases of human trafficking which also include economic and sexual exploitation. If this is the case, it would be reasonable to expect that, in proportion, people who are economically exploited in human trafficking would also be more likely to report their case than those who are sexually exploited in human trafficking just as they do in forced labour. ILO does not tell readers what the make up of the *reported cases*

of human trafficking are exactly but there is evidence from other organizations, which puts their assertion into question.

One example is the United Nations Office on Drugs and Crime (UNODC). The UNODC also collected information on the reported cases of human trafficking. Their data suggests that 79% of reported cases were in forced sexual exploitation and that 18% were in forced labour (here referring to human trafficking for purely economic exploitation and not sexual exploitation).⁹⁷ These were solely cases that authorities in the participating countries provided, meaning their methodology differs slightly from the ILO's, but this does not mean it should be disregarded entirely. The data provided by UNODC suggests that as a total of reported cases, far more deal with sexual slavery than purely economic exploitation in human trafficking. This coupled with the ILO's assertion, that the duration one stays in forced labour, as a fraction of 10 years, is on average proportional to their likelihood of reporting that case, means one of two things. One, there are a miniscule number of people who are exploited as victims of economic exploitation, or two, the ILO's assertion is inaccurate in regards to human trafficking. If victims in economic exploitation are more likely to report their case than those in sexual exploitation and only 18% of reported cases of human trafficking refer to cases of economic exploitation, while 79% refer to cases of sexual exploitation, then a person could believe there very little human trafficking for economic exploitation throughout the world. Imagine there are 1000 *reported* victims of human trafficking, 20% of which are economic and 80%, which are sexual. Pretend that 70% of all cases of economic exploitation in human trafficking are reported and 30% of cases in human trafficking for sexual exploitation are reported. This means that the total number of victims in human trafficking for economic exploitation is

⁹⁷ United Nations Office on Drugs and Crime. *Global Report on Trafficking in Persons*. UN.GIFT, UNODC, 2009. 50

$1000 * .20 = 200$ reported victims of trafficking in economic exploitation

$200 = x * .70$

$\frac{200}{.70} \approx 286$ reported and unreported victims of economic trafficking

Then the number of victims of human trafficking for sexual exploitation would be

$1000 * .80 = 800$ reported victims of trafficking in sexual exploitation

$800 = x * .30$

$\frac{800}{.30} = 2,667$ reported and unreported victims of sexual

One would be hard pressed to provide evidence that human trafficking is almost purely based on sexual exploitation though, and so the first possibility, that very few people are exploited purely for economic reasons and not for sex, does not seem to be a viable option. It must be then that the assertion ILO makes is inaccurate when applied to human trafficking. Human trafficking, according to the ILO, accounts for 20% of all forced labour though.⁹⁸ This alone could alter the total estimate of those in forced labour significantly if incorrect. If the organization's estimate for human trafficking is not trustworthy, then the whole estimate for those in forced labour might also not be trustworthy based on contradictory evidence concerning $\frac{u_h}{p_h} = 1$

The fourth problem is the criteria used for considering a piece of information reliable. The authors choose to use sources that they could simply identify the author or organization involved rather than evaluating the methodology used. Though this makes the study more feasible, it also adds concern. Simply because the person can be identified it does not mean that the story or estimate is reliable. It is possible a person has interest in over reporting the number of people in a specific case of forced labour and this could cause concern. As Bales suggests, there are potential problems with almost every information source. Bales notes that sometimes

⁹⁸ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 4

NGOs are tempted to overstate problems.⁹⁹ This could be because the organizations are competing with other causes or even each other for scarce resources. It might be beneficial to perform a study to see if misreporting is a widespread problem.

The fifth problem is that of the standard error. The standard error again measures the distance of a standard deviation. The authors determined in this study there is a standard error of 2.5 million. This is a high number but the problem really is not that. The problem is that the authors decided to use only one standard error (approximately the 68th percentile), even though rarely is anything under two standard errors (approximately the 95th percentile) considered acceptable. It is important to understand this. If only one standard error is used, this means that out of 100 tests, only 68 times will the number produced be in the confidence interval of 9,800,000 to 14,800,000. Generally, this is not very acceptable in statistical analysis. Two standard deviations is the norm. This means that out of 100 tests, approximately 95 of the test will fall in the range created by two standard deviations, which is 12,300,000±5,000,000. In other words if the test were performed 100 times, approximately 95 of those times the number produced would lie between 7.3 million and 17.3 million. Reporting anything less than the 95th percentile suggests a lack of understanding concerning normal statistical reporting, or a sense of discomfort about the range created by the 95th percentile. The range created by the 95th percentile is very large. In fact, it really is too large to be useful for almost anything.

Despite the problems with this particular study, it is by far the most advanced and clear methodology for the production of an estimate the international level. These specific issues could be worked around and this methodology could be built upon to produce a more reliable estimate in the future.

⁹⁹ Kevin Bales. *Understanding Global Slavery: A Reader*. Berkeley and Los Angeles California: University of California Press, 2005. 98

Conclusion

Though estimating the number of people in modern forms of slavery throughout the world is not an easy task it is necessary. There have been several attempts to estimate the number of victims. These attempts are an important place to start, but in any discipline there is a continual development of methods and this should also be expected in the research of modern forms of slavery. By learning the benefits and the shortfalls of these methods, the development and improvement of methodologies is possible. The purpose of this study was to explain the pitfalls of previous attempts to estimate victims within this field.

Accuracy in estimating is essential for creating effective policies for fighting modern slavery and for determining the most effective use of funds. Ultimately, a coherent policy cannot be determined and funds cannot be targeted appropriately if there is not an accurate estimate. The policy prescription is quite different for 10,000 victims in modern forms of slavery compared to 1,000,000. It is difficult to obtain an accurate estimate though because definitions are often contradictory, ill stated, interpreted in multiple ways or simply missing; slavery is often hidden from outsiders; there are concerns with the ethicalness of observing the population; and there is a lack of understanding concerning methodological and statistical principles.

While some organizations examined in this study decided to use estimates produced by others or to use the number of assisted victims rather than an estimate, a few organizations decided to create their own. There are costs and benefits to any of these options. For example, while it is helpful to know how many victims are assisted, especially for donors who are supporting programs to assist victims, this number cannot be used to understand the scale of modern forms of slavery. Additionally, organizations that choose to use other organization's estimates are in danger of promoting bad statistics.

In the latter group of organizations, the ones that produced their own estimates, there were three distinct techniques used to produce the estimates. Kevin Bales and his assistants used

their definition to produce estimates of the number of slaves in 111 countries. Data came from a wide variety of public sources as well as some on the ground observations. This information, along with advice and feedback from experts, was used to create the final country level estimates, which were then compiled to create an international estimate of slavery. He estimated there are 27 million slaves worldwide.

Several major issues arise though. The sources Bales uses are questionable, there is uncertainty about how the original estimates were created, several countries are missing from the analysis, no information is provided on the experts who examined the original estimate, the measure of slavery is now outdated, and the study is not replicable. While the level of detail provided by Bales through his country level estimates is fascinating and monumental in the field, it is not replicable primarily due to the ambiguous creation of the original estimate and the use of non-identified experts. Replicability is an essential element in any scientific inquiry.

The *Trafficking in Persons Report* produced by the United States Department of State is one of the most often cited sources on human trafficking. Though the Department of State provides nearly no details concerning its methodology, some details are clear. For example, data came from interviews, document reviews, focus groups, panel discussions, e-mail correspondences, the ACCESS Database, and through regional visits. The Government Accountability Office (GAO) claims that the estimate produced by the Department of State is formed through a Markov Chain Monte Carlo method (MCMC) with Bayesian Inferences.¹⁰⁰ The main problem with Markov Chain Monte Carlo methods is in the process. Since the researcher must start with previous information, it is hard to determine where independence from the starting

¹⁰⁰ U.S. Government Accountability Office. *Human Trafficking: Better Data, Strategy, Reporting Needed to Enhance U.S. Antitrafficking Efforts Abroad*. Report to the Chairman, Committee on the Judiciary and the Chairman, Committee on International Relations, House of Representatives, Washington, D.C: United States Government Accountability Office, 2006. 45

point begins. Additionally, simulation programs are complex and difficult to write in computer code. This means that a lot of errors tend to occur and these errors are difficult to detect.¹⁰¹

The GAO suggests there are other issues, which are not addressed in the creation of the estimate in the 2003 *Trafficking in Persons Report* including the fact that one person, who did not record every step used, created this estimate; the country level data, used in the MCMC to create the estimate, for the most part, are not comparable, reliable or even available; the estimate only examined cross border trafficking though trafficking does occur internally; and the estimate can only represent a particular one year period. The lack of clarity concerning the methodology means that this study is also not replicable.

The International Labour Organization's (ILO) international estimate focuses on forced labour by using a technique known as the Capture-Recapture method. This process uses the number of cases collected by two teams as well as the amount of overlap to produce an estimate of total cases. They did this by estimating the number of reported cases of forced labour from 1995-2004 through a Capture-Recapture methodology, estimating the number of unreported victims during this period and then using certain assumptions about the duration of forced labour and the likelihood one will report their case to estimate the number of victims at any one time (both reported and unreported cases).¹⁰²

The authors note the possibility of sampling errors and coverage errors. Additionally, though, there are problems with several of the assumptions necessary for the Capture-Recapture method to be successful, including questions of independence between the two teams, concerns that the probability of being captured was not equal for all reported cases, and uncertainty that the authors adequately addressed the problem of an non-closed population. Further, there is evidence

¹⁰¹ Fred W. Allendorf, and Gordon Luikart. *Conservation and the Genetics of Populations*. Malden, MA: Blackwell Publishing, 2007. 566

¹⁰² Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 14

within the study of bias from the possibility that unreported cases are fundamentally different from reported cases, the fact that there are widely divergent numbers of observations between the two teams in regards to the regions they examined, the unrealistic assumption that the average time one spends in forced labour as a proportion of ten years divided by the likelihood someone will report their case is equal to one ($\frac{u_h}{p_h} = 1$), and the questionable criteria used for determining a case of forced labour as reliable. Finally, by choosing to use one standard error rather than two for the final estimate, the authors have left the impression that they are trying to hide something.

While the ILO's study goes into the most depth detailing how the estimate was produced, it is easy to get lost due to unclear explanations and questionable assumptions. The technique is innovative and likely to be very beneficial in the future but must be improved before it can really be useful.

Where to Go From Here

Kevin Bales says the field of modern slavery is creating a "protoscience."¹⁰³ One could not blame the outside world for thinking the field is more of a pseudoscience though, concerned more with appearances than with methodological soundness. Bales says "(i)n the current phrase, we 'have to think outside the box.' We must; we are building a new box,"¹⁰⁴ To this point though, all that has occurred is the creation of a box without a base. From afar, it looks like a box, but when you attempt to use it everything falls through.

In order to avoid remaining a pseudoscience, a box without a base, five things must occur. First, there need to be more researchers who are willing to collect sound data. Many are quick to note this issue, but it is important that people fighting modern forms of slavery understand the seriousness and depth of this problem. It is possible that the ILO was right to

¹⁰³ Kevin Bales. *Understanding Global Slavery: A Reader*. Berkeley and Los Angeles California: University of California Press, 2005. 111

¹⁰⁴ Ibid.

assume that $\frac{u_h}{p_h} = 1$, but more data is necessary to test this assumption. Otherwise, there is only theory and logic. These are by no means bad in and of themselves, but to rely on logic alone would lead many to believe that heavier objects fall faster than lighter objects. They do not; the data says so. If there is not sound data to point to, research related to modern forms of slavery is in limbo and likely to not be considered substantive by others.

Second, triangulation, the process of either using multiple methods or having several researchers perform a study to “double-check” the results, should become standard in the field of modern forms of slavery. Triangulation can be done in three ways.

1. One researcher uses more than two methods or more on the data
2. Two or more researchers perform a test using the same method
3. Two or more researchers perform two or more of the same methods on the data¹⁰⁵

In this field though, triangulation has taken an un-holy form. A researcher will do their own study, then find another person with similar results and suggest that somehow since someone else found something similar that their study must be correct. The problem is that just because someone else says something similar, this does not mean the results of the study are trustworthy, especially when the methodologies of the studies or definitions are not the same. Too often people compare their results with other researchers who are using different definitions, and different methodologies and try to pass this off as a form of triangulation, showing that there is some truth or reason to believe their results are good. This is negligent and not beneficial for the field. It also leads to the promotion of bad statistics and estimates; the exact thing that needs to be avoided.

Third, some authors do not clearly state their methodology, and others think they have. It is clear that the Department of State does not detail their methodology. The ILO, on the other

¹⁰⁵ Lee Harvey, and Morag MacDonald. *Doing Sociology: A Practical Introduction*. New York: Palgrave Macmillan, 1993.

hand, does provide their methodology and even explains portions of the methodology in detail but it is extremely complex and the average person is left more confused than satisfied. Without a good understanding of math and absolute determination, the explanation of the methodology will elude most. Even with an understanding of mathematical principles one is left questioning how exactly the process was completed. This likely prevents most people from understanding how the estimate is created. Many seem to think that if a methodology is complex, it must be good. This is not the case. Additionally, there is usually a disconnect between those who collect the data and those who process the data. If those who collect the data do not understand what it is used for how can they be expected to collect relevant data? One solution to this problem would be, to ask many different types of people to read and “replicate” the study before it is published. Another would be to have methodological addendums to estimation studies detailing every step and rationale. This may be cumbersome but one reason research in modern forms of slavery is not progressing is that too many people are outright discouraged by the lack of clarity regarding methodology. These addendums along with ensuring the methodologies are understandable to the average researcher, will likely lead to quicker developments in methodologies. Time wasted attempting to understand what method the authors actually used to produce a study, rather than the over simplified but mostly not useful version that is often presented, could be used to actually improve methodologies.

Fourth, open critique of others' methodologies is and will continue to be essential for progress. To this point, it seems that few are willing to openly critique others methodologies. Such critiques, though, are absolutely essential to furthering thought on how to improve methods. Each person has different insight and perspectives on problems and so any insight about potential problems need to be addressed openly and honestly. These issues cannot be ignored. If creating a decent methodology is the goal, each researcher needs to be willing to accept that the methods they spent so much time and effort to create might not be perfect and welcome critiques from

others. Science is a continuous progression of thoughts and ideas. Methodologies for estimation are the same.

Fifth, further exploration of how to utilise Monte Carlo and Capture Recapture Methods as they relate to estimating modern forms of slavery is necessary. Both hold so much prospect. Unfortunately, it is unclear how the Department of State used Monte Carlo, so it cannot be critiqued, but it has been used in similar studies and it appears that with some alteration it could be very useful for estimating the number of victims. The ILO's Capture-Recapture method is an excellent start but there are too many problems with the assumptions used for the study. If these issues are examined and successfully addressed, the methodologies would be more viable for this field.

There are certainly other potential steps to take in order to advance estimation methodologies for modern forms of slavery, but these are a start. Until these five goals are seriously pursued, estimation of modern forms of slavery will remain a pseudoscience, little better than astrology.

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Appendix A: Discussion of the Lincoln-Peterson Method

To understand why this formula works it is best to start with a rearrangement of the formula.

$$\frac{C}{A} = \frac{B}{N}$$

This relationship is not necessarily intuitive but is based on a few basic assumptions. First, A and B are random and therefore theoretically unbiased samples. There is nothing fundamentally different about A and B even if they are different numbers. Second, if both of these samples are random and representative of the population it can be assumed that C, the overlap, is not biased and thus that it is also representative since it is drawn from the overlap in A and B. Third, if A is unbiased and representative of the population as a whole, it can be treated as the population in the first fraction, since it is a representative fraction of N. Remember that

$$\frac{1}{2} = \frac{4}{8}$$

even though

$$1 \neq 4$$

$$2 \neq 8$$

In other words, although the numbers may be different, the proportions are the same. Going back then, C is treated as the sample of A since it represents the group within A that was recaptured. In other words, C is the sample of population A that was captured. B acts as the sample and N is obviously the population in the second fraction. B also acts as a scale since N is still not known. Remember that if 8 was unknown in the above example one could rearrange the equation to show

$$N = 4 * \frac{2}{1}$$

Where B=4 and 4 is the scale. Thus C, the recaptures, is the same proportion to A as B is to N since both C and B are acting as unbiased samples of populations A and N. Once this is known, these can be rearranged back into the original formulation to solve for N.

Appendix B: Finding the Probability a Case is Captured

$$\pi_i = p_1 + q_1 p_2$$

$$p_1 = \frac{n_1}{N}$$

$$q_1 = 1 - \frac{n_1}{N}$$

$$p_2 = \frac{n_2}{N}$$

This is where p_1 represents the probability that Team One discovers case i , q_1 is the probability that case i is not discovered by Team One and p_2 is the probability that case i is discovered by Team Two.¹⁰⁶ Also n_1 represents the number of cases Team One captured, N equals the estimated number of total reported cases (captured and those that were not), and n_2 represents the number of cases captured by Team Two.

The equation fully written out is:

$$\pi_i = \frac{n_1}{N} + \left(1 - \frac{n_1}{N}\right) \left(\frac{n_2}{N}\right)$$

Here it is not important who captures the case, just what the probability is of it being captured at all. To illustrate, imagine

$$p_1 = \frac{3}{4}$$

$$q_1 = 1 - \frac{3}{4}$$

$$p_2 = \frac{1}{2}$$

The probability that this case will be captured is

¹⁰⁶ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 19

$$\pi_i = \left(\frac{3}{4}\right) + \left(\frac{1}{4}\right)\left(\frac{1}{2}\right)$$

$$\pi_i = \left(\frac{6}{8}\right) + \left(\frac{1}{8}\right) = \frac{7}{8}$$

From this it is apparent that the probability Team One will capture the case is 75%. Assume that each case within this grouping has equal probability of being captured, and Team Two has been capturing 50% of all general cases. Since Team One is capturing 75% of cases, and since the overlap/recaptures should not be counted, it is then only important to know of the 25% that are left what percentage will Team Two capture? There is no reason to believe that Team Two will capture at a different rate than it was previously since this is an unbiased population. So, of the 25% that is left, Team Two will capture 50%. Again, all that is answered here is “what is the likelihood that Team One will capture the case and should they not, that Team Two will capture it?”

In reexamining the equation,

$$\pi_i = \frac{n_1}{N} + \left(1 - \frac{n_1}{N}\right)\left(\frac{n_2}{N}\right)$$

it becomes apparent that the equation is not in useful form.¹⁰⁷ By using some simple algebra, the equation can be restructured to show that

$$\pi_i = \left(\frac{(n_1 + n_2 - n_{12})}{(n_1 n_2) / n_{12}} \right)$$

This equation looks a lot more complicated than it actually is. Remember that

$$n_1 + n_2 - n_{12} = n$$

¹⁰⁷ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 19

This is simply the number of unique cases captured.¹⁰⁸ Based on basic Capture-Recapture methods it is also true that

$$\frac{n_1 n_2}{n_{12}} = N$$

in other words, the number of cases (both that were captured and those that were not). Thus all the equation above is saying is

$$\pi_i = \frac{n}{N}$$

meaning the probability a case will be discovered is equal to the number of cases that were captured divided by the number of cases estimated in the population as a whole by the Capture-Recapture Method.¹⁰⁹

¹⁰⁸ Patrick Belser, Michaëlle de Cock, and Farhad Mehran. *ILO Minimum Estimate of Forced Labour in the World*. Geneva: ILO, 2005. 19

¹⁰⁹ Ibid. 20

Appendix C: Definitions

As stated towards the beginning, this paper deals with several different concepts including slavery, human trafficking and forced labor. It is important to remember that while these concepts are similar, the estimates created by the organizations are dependent on how they define the phenomenon of interest. In the introduction and concluding sections the term modern forms of slavery is used to encompass all of these concepts. The specific concepts that are estimated are listed below along with the definition that person/organization provided.

Kevin Bales

Slavery

“a social and economic relationship, in which a person is controlled through violence or its threat, paid nothing and economically exploited.”¹¹⁰

United States Department of State

Severe Forms of Trafficking.

“(A) sex trafficking in which a commercial sex act is induced by force, fraud, or coercion, or in which the person induced to perform such act has not attained 18 years of age; or

(B) the recruitment, harboring, transportation, provision, or obtaining of a person for labour or services, through the use of force, fraud, or coercion for the purpose of subjection to involuntary servitude, peonage, debt bondage, or slavery.”¹¹¹

International Labour Organization

Forced Labour

Their definition emerges from ILO Conventions 29 and 105 the relevant portions of the Conventions are listed below

¹¹⁰ Kevin Bales. *Understanding Global Slavery: A Reader*. Berkeley and Los Angeles California: University of California Press, 2005. 29

¹¹¹ 106th Congress. "Victims of Trafficking and Violence Protection Act of 2000." Washington, D.C.: United States Congress, October 28, 2000.

ILO Convention 29

Article 2

“1. For the purposes of this Convention the term ***forced or compulsory labour*** shall mean all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily.

2. Nevertheless, for the purposes of this Convention, the term ***forced or compulsory labour*** shall not include--

(a) any work or service exacted in virtue of compulsory military service laws for work of a purely military character;

(b) any work or service which forms part of the normal civic obligations of the citizens of a fully self-governing country;

(c) any work or service exacted from any person as a consequence of a conviction in a court of law, provided that the said work or service is carried out under the supervision and control of a public authority and that the said person is not hired to or placed at the disposal of private individuals, companies or associations;

(d) any work or service exacted in cases of emergency, that is to say, in the event of war or of a calamity or threatened calamity, such as fire, flood, famine, earthquake, violent epidemic or epizootic diseases, invasion by animal, insect or vegetable pests, and in general any circumstance that would endanger the existence or the well-being of the whole or part of the population;

(e) minor communal services of a kind which, being performed by the members of the community in the direct interest of the said community, can therefore be considered as normal civic obligations incumbent upon the members of the community, provided that the members of the community or their direct representatives shall have the right to be consulted in regard to the need for such services.”¹¹²

ILO Convention 105

Article 1

“Each Member of the International Labour Organisation which ratifies this Convention undertakes to suppress and not to make use of any form of forced or compulsory labour--

(a) as a means of political coercion or education or as a punishment for holding or expressing political views or views ideologically opposed to the established political, social or economic system;

(b) as a method of mobilising and using labour for purposes of economic development;

¹¹² International Labour Organization. "C29 Forced Labour Convention, 1930." Geneva, 1930.

- (c) as a means of labour discipline;
- (d) as a punishment for having participated in strikes;
- (e) as a means of racial, social, national or religious discrimination.”¹¹³

¹¹³ International Labour Organization. "C105 Abolition of Forced Labour Convention, 1957." Geneva, 1957.