Annexe 1.3 Methodology

This annexe provides supplementary information on the methodology used in Chapter 1 to calculate the dollar value estimate of USD 1.58 billion for firearms transfers worldwide in 2006. The estimate, and the process by which it was derived, is part of a multi-year effort to reassess the Small Arms Survey's current estimate of USD 4 billion for the annual authorized international trade in small arms; light weapons; and their parts, accessories, and ammunition.[1]

Caveat regarding data and estimates

It is important to note that the USD 1.58 billion figure is simply an estimate; ambiguities and gaps in existing data preclude the calculation of a definitive total. Many exporting countries provide only partial data on their firearms exports and some provide no data at all. Other countries aggregate their data on firearms exports with data on other arms transfers, or provide only data on licences issued rather than actual exports. Furthermore, the different reporting mechanisms through which governments provide data on firearms exports are not standardized, making it difficult to combine data from different sources and corroborate individual data points. For example, some reports only provide data on the number of units exported, while others only provide monetary values. Compounding these problems are ambiguities and errors in the data. For these reasons, the estimates provided in Chapter 1 should be viewed as approximations based on existing, publicly available data rather than a definitive account of the actual trade.

Countries studied

Data was collected on transfers from 53 countries. These countries include the largest exporters (in dollar value terms)[2] of small arms and light weapons in 2006 based on customs data, along with several other countries believed to have significant actual or potential export activity, but that we suspected of not publishing customs data on all of their arms exports.

These 53 countries are (in alphabetical order): Albania, Argentina, Australia, Austria, Bangladesh, Belarus, Belgium, Bosnia-Herzegovina, Brazil, Bulgaria, Canada, China, Croatia, Cyprus, the Czech Republic, Denmark, Egypt, Finland, France, Germany, Hong Kong, Hungary, India, Iran, Israel, Italy, Japan, Malaysia, Mexico, the Netherlands, North Korea, Norway, Pakistan, the Philippines, Poland, Portugal, Romania, the Russian Federation, Serbia, Singapore, Slovakia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, Ukraine, the United Kingdom, the United States, and Venezuela.

Data sources

Most of the data on transfers from the aforementioned countries came from the following sources:

- the United Nations Commodity Trade Statistics Database (UN Comtrade) (UN Comtrade, n.d.);
- the United Nations Register of Conventional Arms (UN Register) (UNODA, n.d.);
- the *Annual Report According to Operative Provision 8 of the European Union Code of Conduct on Arms Exports* (EU Report)[3] (CoEU, 2007);
- national arms export reports;

- the Norwegian Initiative on Small Arms Transfers (NISAT) Small Arms Trade Database (NISAT, n.d.);
- other regional and country-specific sources, including Eurostat and URUNET;[4] and
- field research on exports from the Russian Federation, Ukraine, and Bulgaria conducted by country experts.

Comparing and integrating the data

The data collected from the sources listed above was integrated in the calculations following a comparative analysis of the data sources and, in some cases, of individual data points. A hierarchy of sources was developed to aid in the selection of data when two or more data points conflicted (see 'Hierarchy of sources', below). When the quantity (units) of firearms transfers was provided, but not their value, the unit data was converted into values by using average unit prices calculated from data on past sales of the same (or comparable) firearms by that country. When country-specific data on unit values was not available, or not available in sufficient quantity to produce a reliable estimate, a global average unit price—calculated from seven years of data from customs filings and national reports—was used (see the section entitled 'Calculating global average unit prices', below).

Dollar value estimates of exports were then calculated for the three main categories of firearms used in the chapter (e.g. military firearms, pistols and revolvers, and sporting shotguns and rifles) for each of the 53 countries. A separate 'Firearms (unspecified)' category was created for cases in which data on transfers of two or more of the main categories of firearms was combined by the original source in a single category. The category totals for each country were then added together to derive total global dollar values for each category of firearms, as presented in Table 1.22 (reproduced here).

Table 1.22: Estimated* small arms exports from 53 countries, aggregated by category, 2006

Category	UN Comtrade total (USD)**	Revised estimate (USD)**	% difference
Military firearms	244 million	321 million	32
Pistols & revolvers	428 million	430 million	<1
Sporting rifles & shotg	756 million	779 million	3
Firearms (unspecified)	N/A	39 million	N/A
Total	**1,428 million**	**1,568 million**	**10**

* It is important to stress that these values are only estimates. As explained in Box 1.2, data limitations preclu definitive assessments of even the most transparent countries.
** Totals are rounded to the nearest million. Differences between the sum of the category totals and the "Tota figure are due to rounding.

Hierarchy of sources

For various reasons, data from one source often does not concur with corresponding data from other sources. Country X might submit data to UN Comtrade indicating that it exported 2,000 pistols valued at USD 1 million to Country Y, while Country Y's submission to the UN Register might indicate that it only imported 1,500 pistols from Country X. Given the limitations of existing data sources, the sheer quantity of transfers, and resource and time constraints, reconciling the tens of thousands of data points for 2006 individually would have been impossible. Instead, a hierarchy of sources—a ranking of sources based on the author's

knowledge of the strengths and shortcomings of each source—was developed to systematize the evaluation and selection of data.

National reports, which are compiled specifically for the purpose of conveying information about the arms trade and are often subject to more scrutiny than other sources, were considered the most reliable of the data sources, followed by the data from UN Comtrade as interpreted by NISAT's Reliability Index (see the following section). Data submitted to the UN Register—and national reports in which only data on the number of units transferred is provided—was only used if there was no data on a particular transfer in UN Comtrade. Data from the EU Report was used only if there was no corresponding data in other data sources.[5]

Data from UN Comtrade was favoured over data from the UN Register (which only contains data on the number of units exported, not their value) and national reports that only report on exported units, because of the inherent imprecision of converting data on units into values. Furthermore, some countries' submissions to the UN Register are based on licensing data rather than actual exports. Whenever possible, data on licences issued was excluded, as there is no way to know if the licensed items were actually exported in 2006. The EU Report ranks last in the hierarchy because it combines data on transfers of multiple categories of firearms (along with some accessories) into a single category, making it difficult to compare the data in the report with data from sources that disaggregate the data into separate categories.

Occasionally the hierarchy of sources was adjusted to reflect country-specific variations in data submissions and reporting requirements. In the case of the United States, for example, the hierarchy was rearranged to reflect, among other things, the absence of data on deliveries of commercial firearms exports in the national report.

The NISAT Reliability Index

Firearms transfers are typically reported to UN Comtrade as an export by one country and an import by another. Sometimes there is little difference between the two figures, but in other cases they diverge significantly. Because of this, NISAT developed its Reliability Index to help determine when to use the data provided by the exporter and when to use data provided by the importer. The Reliability Index is produced by a computer program that compares all of a country's transfers reported to UN Comtrade—in a particular year and of a certain customs category—with all the reports by its trade partners. If, overall, there is a high degree of congruence between the transfers reported by a given exporter and the countries importing those items, then the exporter receives a high score on the Reliability Index. Conversely, exporters that consistently report transfers with very different values from those reported by importing states receive a lower score. It is important to note that the Reliability Index is applied only to data reported to UN Comtrade.

Calculating global average unit prices

The global average unit prices for firearms used in Chapter 1 were calculated using data from NISAT's database. Only records containing information on both the value and number of units transferred were used.[6]

NISAT divides its data into the following categories and assigns the codes found in parentheses:

1) Pistols & revolvers (commodity code 210);

2) Rifles/shotguns-sport (commodity code 220);
3) Rifles/shotguns-military (commodity code 230);
4) Machine guns-sub & light (commodity code 240);
5) Military weapons (commodity code 250); and
6) Heavy machine guns (commodity code 310).

The following process was used to calculate the global average unit prices for pistols and revolvers (USD 400) and sporting shotguns and rifles (USD 700) transferred worldwide in 2006:

1. We converted other currencies into US dollars.
2. We calculated a price per unit.
3. We eliminated the outliers.
4. We calculated a final average (mean) price, based on the distribution without the outliers.

There were insufficient observations during 2006 to make a reliable estimate for military rifles and shotguns, so data from several years was used. The following process was used to calculate the global average unit prices for military rifles and shotguns (USD 1,100), light machine guns and sub-machine guns (USD 1,300), and heavy machine guns (USD 12,000) transferred worldwide in the period 2000–06:

1. We converted other currencies into US dollars.
2. We deflated the values for transfers occurring in the years 2000–06 using the US Department of Commerce's National Income and Product Accounts Table 1.1.9 (United States, 2009).
3. We eliminated the outliers.
4. We calculated a final average (mean) price, based on the distribution without the outliers.

Outliers

After plotting the distribution of the data points from relevant entries in NISAT's database, it was apparent that the mean value for each weapon type was being distorted by a small number of records (less than 10 per cent) that were either very high or low. There are two possible explanations for these extreme prices. The most likely is that in some cases the data was erroneous (perhaps due to bad reporting). It is also possible that the records represent accurate, but atypical prices for some firearms. For example, a USD 10,000 pistol could be a very rare collectors' item, and firearms valued at less than a dollar could be part of military aid. In both cases, it was necessary to remove the price observations at the extreme ends of the scale. This is because our aim was not to find the mean of *all* price observations, but to generate a typical price that could be used as a generic figure when converting data on units into a dollar value.

The cut-off points for pistols and revolvers, and sporting shotguns and rifles were as follows:

Category	**Cut-off points for distribution**			
	Percentile	Lower cut-o point (USD)	Percentile	Upper cut-off point (USD)
Pistols & revolv (210)	2.9%	74.47	97.1%	1,600.00
Sporting rifles & shotguns (220)	3.0%	106.20	97.0%	7,000.00

Source: Data selection of unit observations supplied by Nic Marsh of NISAT

The cut-off points for military firearms were as follows:

Category	Cut-off points for distribution			
	Percentile	Lower cut-off (USD)	Percentile	Upper cut-off point (US
Rifles/shotguns-mil (230)	3.0%	19.33	97.0%	8,095.40
Machine guns-sub a light (240)	25.9%	517.87	74.1%	4,913.81
Military weapons (2	3.0%	15.10	97.0%	9,316.00
Heavy machine gur (310)	11.3%	1,460.51	88.7%	35,000.00

Note: Code 250 equals codes 230 + 240 + 310.
Source: Data selection of unit observations supplied by Nic Marsh of NISAT

Firearms transfers from the former Soviet bloc

In the case of military firearms, most of the observations used for the estimates were exports from Western industrialized countries. In the case of heavy machine guns, the observations were mostly from the United States. Average unit prices derived from these observations were not applicable to transfers from major exporters of military surplus in Eastern Europe or former Soviet republics. The unit price for surplus weapons is often significantly lower than the price for new Western weapons. Therefore, the average unit price for exports of surplus stocks from some former Soviet bloc countries is based on the average unit price of comparable exports from Ukraine instead of the above process. Data on Ukrainian exports was selected as the basis for comparison for the following reasons:

1) Research conducted by analyst Maxim Pyadushkin (2008) confirmed that Ukraine exports surplus weaponry and that most of what is exported is pre-Second World War weapons, weapons from the Second World War, and early cold war materiel. According to Pyadushkin, these firearms are very inexpensive and old, and are sold mainly to collectors and hunters (who use bolt-action military rifles for hunting).

2) NISAT's Small Arms Database contained enough detailed observations for Ukrainian firearms exports from 2000–06 (the period under study) to calculate deflated average prices.[7]

Authors:

Júlio Cesar Purcena, Pablo Dreyfus, Nic Marsh, Matt Schroeder, and Marcelo de Sousa Nascimento

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Endnotes

[1] Note that the methodology described in this annexe was not used to estimate the value of the undocumented trade. This is because the detailed information on the quantity and value of firearms transfers required for the methodology used to measure the documented trade is, by definition, unavailable in cases of undocumented transfers. The methodology for assessing the value of the undocumented trade is outlined in Box 1.3 of Chapter 1.

[2] For the purposes of this chapter, the largest exporters were those that exported small arms; light weapons; and their parts, accessories, and ammunition valued at USD 4 million or more in 2006.

[3] Also known as the Consolidated EU Report.

[4] URUNET is a paid service that provides customs information for several Latin American countries and Spain.

[5] The EU Report combines data on all firearms transfers in a single category (ML1), which includes all '[s]mooth-bore weapons with a calibre of less than 20 mm, other arms and automatic weapons with a calibre of 12,7 mm (calibre 0,50 inches) or less and accessories … and specially designed components therefor'. Since the EU Report does not indicate which specific types of firearms were transferred in any given case, data from the report was included only when there was no corresponding data from other sources.

[6] The methodological guidelines and price parameters used for these estimates can be found in Marsh (2006). Note that, unlike the estimates in Marsh (2006), which are based solely on data from UN Comtrade, a broader array of data from NISAT's database was used for the chapter, including data taken from national reports and Eurostat.