Introduction

The international trade in arms is an issue of major concern for many reasons: unrestrained trade in arms can lead to destabilizing arms build-ups, threatening regional stability; it fuels civil wars and external military interventions leading to massive civilian death and suffering, caused by both government forces, rebel groups and external interveners; props up dictatorships and human rights-abusing regimes; it also diverts enormous resources from potential civilian uses, including through the vast corruption often associated with the trade. On the other hand, many states view the export of arms as a key tool of foreign policy and a means of strengthening allies. Almost all arms exporters maintain a rigorous system of export controls—which generally do not stop the sale of arms to questionable recipients, but which do ensure that transfers (usually) only occur with the permission of the government—and an Arms Trade Treaty was recently signed by most UN member states as a first attempt to bring some form of international regulation to the trade.

In the light of this, it is perhaps surprising, and certainly unfortunate, that the data on the international arms trade is so poor. For a phenomenon so significant in international relations, access to clear and reliable data is of enormous value for both citizens and policy-makers. But, as this article will discuss, even estimating a figure for the total value of the legal world trade in arms is fraught with difficulties, and breaking this down in more detail, in terms of buyers and sellers, is even more problematic. This article will attempt to produce such a global estimate, or rather a range of estimates, while explaining the problems with the data, including for some of the largest western arms exporters, from whom one might expect a greater level of transparency: most notably, the USA.
Section 1 specifies the question of what we are seeking to measure more precisely. Section 2 examines the sources of data on the international arms trade, and the availability of data for different countries. Section 3 attempts to build an estimate of the global arms trade, going through the key arms exporters country by country, explaining the problems with the data and attempting to derive reasonable estimates on the basis of the available information. Section 4 reflects on the issues and problems revealed by this exercise, and concludes.

1. Defining the international arms trade

Before we can measure something, we need to be clear what we are measuring. For the purposes of this article, we are defining the international arms trade as the permanent transfer between countries of military equipment, to the armed forces of the recipient country or to non-state armed groups. By ‘military equipment’, we include weapons and ammunition (including personal firearms when transferred to a military customer or non-state armed force, but not e.g. to police forces or to civilians for self-protection or sporting purposes), and all equipment and services with a specifically military purpose, or that has been specifically adapted for military use.

In setting out this definition, it is important to emphasize what this is not. First of all, we are not talking about total world military expenditure, which is much larger than the value of total arms production, let alone trade. There is data for this (disclaimer; I produced it until recently), in the SIPRI Military Expenditure Database. Journalists and commentators who ought to know better often describe these figures, wrongly, as total world “arms spending, but in fact most military spending goes on salaries and regular running costs (fuel, supplies, services, etc.) rather than arms.

Secondly, we are not talking about the total output of the world’s arms industries. Most military equipment produced today is for the use of the armed forces of the country in which it is produced, and is therefore not transferred overseas. Annual US procurement spending, for example, is over $100 billion a year, and the vast majority of this is spent with US industry. There is also more than $60 billion a year for R&D, some of which is conducted in-house by the DOD, but most of which is performed by US industry. Other major spenders, China, Russia, France, the UK, Germany etc. likewise procure the great majority of the arms used by their armed forces domestically. Among the top spenders, only Saudi Arabia and India, lacking a sufficiently well-developed domestic industry, import most of their arms.

For a variety of reasons (top of the list being the lack of transparency in China), estimating total world arms production is an even harder problem, but we are concerned here with the international trade in arms.

We will restrict attention to the legal arms trade, which is either conducted directly or is authorized by governments. Naturally, the scale of the illegal trade in arms is essentially impossible to measure, but it is certainly much smaller than the legal trade. Much of the illegal trade consists of small arms and light weapons; where it concerns heavier equipment, it is likely to be second-hand in many cases. While the illegal trade can have devastating consequences in terms of conflict and human rights abuses (as can the legal trade), it is far smaller in financial and military value than the legal, which includes the sale of expensive, high-tech systems such as major combat aircraft, submarines and major surface vessels, etc. A final issue we need to address is, what stage of the arms transfer process we are measuring: this article

1 This may include transfers that violate UN arms embargoes, and are thus illegal under international law. Many legal transfers may also involve illegal activities such as bribes as part of the deal. ‘Legal’ here is simply used to mean that the transfer is authorized by the government of the exporting country.

(footnote continued)
will focus on deliveries, that is the value of arms transfers actually delivered to the importing country in any given year. The other main way of measuring the trade is to look at the total value of orders for arms transfers in a given year. This can be valuable in assessing the state of the market at any given time. However, not all orders turn into actual deliveries of arms (and corresponding payments). Orders and deliveries tend to give very different measures, as of course deliveries take place later, in some cases many years later, depending on the weapons system in question, and how recent the technology is.\(^2\)

## 2. Sources of data on the arms trade

International trade is an area in which there is, for most industries, exceptionally good data, both because it is of enormous economic interest to governments and business, and because all legal international trade transactions are recorded as they pass through customs at both the importer and exporter ends. So why does this not apply to the arms trade?

The [UN Comtrade database](https://comtrade.un.org) has data on imports, exports and re-exports to and from all countries and territories, broken down by Standard Industrial Trade Classification (SITC), based on reporting by countries’ customs authorities. The database was created in the 1960s. Unfortunately, there is no SITC code, or collection of codes, that properly captures the international arms trade. There is a category “Arms and ammunition” (including for civilian use, although the more detailed breakdown allows for a better distinction between military and civil), but this only captures, to put it bluntly, the things that go boom: guns, artillery, missiles, bombs, torpedoes, rocket launchers, etc. There is another category, “Tanks and armored fighting vehicles”, which covers another sector of international arms trade. However, military aircraft and their subsystems are subsumed under broader aircraft and aerospace categories, while naval vessels are subsumed under marine vessels in general. The vast range of military electronics systems, radars, etc., that form a crucial part of military platforms and weapons, are likewise mixed in with the broader civilian category.

The United States, for example, exported $5.4 billion worth of “Arms & Ammunition” in 2016, and $1.7 billion of “Tanks and other armored vehicles” and components thereof. This is only a small proportion of total US arms exports.

This illustrates the key problem with collecting data on the international arms trade: it is not something that is routinely collected as part of international trade activities. Whether data is available for a country therefore depends on whether anyone within the country is actually collecting the data, and then on whether and how much of this data the government chooses to publish. This in turn depends on government interest first in having the data, and secondly in making it available to the public.

Given this lack of a clear international standard for measuring and reporting arms transfers, those seeking to compile data on the international arms trade must rely on a variety of national, international, and media sources of information. A number of organizations, governmental and non-governmental, attempt to produce data on arms transfers at a global level, with both total levels of exports and imports per country, and the levels of transfers between specific pairs of countries.

### The Stockholm International Peace Research Institute (SIPRI)

The most widely cited source, and the one generally accepted as most authoritative (disclaimer: I used to

\(^2\)Other possible measures include the value of arms export licenses; this is of limited value, however, as countries differ very widely in their licensing systems, and the rate of conversion of licenses into actual arms exports varies enormously; payments for arms transfers is theoretically another option, but in practice this is impossible to track.
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help produce it until a year ago) is the SIPRI Arms Transfers Database, which provides detailed qualitative and quantitative information on international arms transfers. According to the most recent data release by SIPRI, the total volume of the trade in major conventional weapons in 2016 was 31,075 million.

Million dollars? No, million “Trade Indicator Value” (TIV) units. What is a TIV unit? For full details, you should read the SIPRI sources and methods. But essentially, it is an attempt to assign a similar value to similar items of military equipment, regardless of the price paid; the reason SIPRI does this is that in many arms deals, the price paid is not publicly revealed. SIPRI also seeks to account for transfers that are made as military aid. First of all, a set of ‘base systems’, mostly US systems, are given a TIV value based on their unit production cost (which is information publicly available in the US), converted into constant 1990 prices. Other, non-US systems, are assigned a TIV value based on the nearest equivalent base system, as judged by the SIPRI team. For example, one of the most advanced Russian combat aircraft, the Sukhoi Su-30MK, is assigned the same value as a US F-35 Joint Strike Fighter. These values are further adjusted if the systems transferred are second-hand, or refurbished, rather than newly-produced.

The quantitative TIV measure is based on a comprehensive database of specific arms deals and deliveries, based on a myriad of sources, including from government, arms companies, general and specialist media, and sometimes private sources such as photographs of military parades, which can help confirm delivery of ordered equipment. The TIV value of the individual items transferred are then summed for each pair of countries and years to produce the global data.

This is a well-tried system, which aims to give an accurate measure of the volume of international arms transfers, including the volume of transfers between specific pairs of countries, which would often be very hard to do for a financial measure. But it does not give us a financial measure, and in fact when looking at specific countries the TIV value of exports or imports often does not correlate very well with financial values, where these are known. The TIV measure can do what the name describes – it can measure trends in the international arms trade, and can also give meaningful comparisons between countries or groups of countries; but the absolute values, the information that the total world arms trade in 2016 was 31,075 million TIVs, is not particularly intuitively helpful. (In fact, SIPRI’s discussion of the data almost always refers only to changes in TIV values, percentages of totals, and relative levels, rather than the absolute numbers, for precisely this reason).

The SIPRI database only covers major conventional weapons, which includes some major sub-systems like engines, radar systems, and tank turrets, but it excludes small arms and light weapons, and other sub-systems and components.

The Congressional Research Service (CRS)

The CRS publishes an annual report on “Conventional arms transfers to developing nations”, which provides data on the international arms trade as a whole (including to developed nations), but with a more detailed focus on transfers to developing countries. According to the 2016 CRS report, the total value of global arms deliveries in 2015 (to developed and developing countries), was $46.2 billion. (The CRS report also measures orders/agreements, which it gives as $79.9 billion in 2015).

This seems straightforward, but there are two problems with the CRS data. First, the CRS does not give any information as to its sources, some of which may come from US intelligence, making it impossible to interrogate their methodology.

More importantly, the figures are, for some countries, directly contradictory to official national sources, where there is no reason to disbelieve the latter. For example, the report gives the total value of deliveries by Italy to be $1.8 billion in 2015, while the EU 18th Annual Report on arms transfers, to which all member states provide data, gives the figure for Italian deliveries as $3.6 billion. The figure given for Germany is $1.8 billion, but this corresponds (approximately),
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only to official German figures for deliveries of Weapons of War, which is a subcategory of military equipment representing only a minority of German arms exports. Figures for some other countries or groups of countries also appear to be unduly low. As discussed above, since CRS does not give any indication of its sources, or the methodology it applies in obtaining their data, it is not possible to understand the reasons for the difference between CRS and official European figures. EU data, by contrast, are based on deliveries made under export licenses granted for equipment on a commonly agreed, and detailed, Military List. While it is likely that these figures are not completely accurate (for example, incomplete reporting by companies), they represent a more solid source than the numbers presented, without background, by the CRS.

world military expenditure and arms trade

The US State Department Bureau of Arms Control, Verification and Compliance produces the World Military Expenditure and Arms Trade (WMEAT) dataset. Up to the late 1990, this used to be published annually, originally by the Arms Control and Disarmament Agency, but was discontinued. It was revived a few years ago by one employee at the State Department who now produces annual updates, generally with data a couple of years in arrears.

The most recent edition of WMEAT, for 2016, provides data on international arms transfers from 2004-2014. The total it gives for the value of the global arms trade in 2014 is $188 billion, over three times the CRS figure. The WMEAT data suffers from one of the same problems as CRS, namely that the sources are non-transparent. But the numbers themselves also share some of the problems with the CRS data. Again, for several European countries, the arms export figures given are far below those provided by the EU Annual Report (and official national sources). The suspicion may arise that US sources are seeking to downplay the importance of European competitors in the international arms market.

The reason that the WMEAT total is so massively higher than the CRS figures, however, is the methodology they have used for estimating deliveries under US Direct Commercial Sales (DCS) exports of military equipment and services.

US arms sales go through two different channels: Foreign Military Sales (FMS), which are government-to-government agreements, where the US sells equipment to a foreign government, and then subcontracts the production of the equipment to a US arms producer. The second is Direct Commercial Sales (DCS), where exports are agreed directly between a US company and the recipient government, requiring a license from the US government. Data for DCS equipment and services authorizations and deliveries for each year are presented in annual Section 655 reports by the State Department’s Directorate for Defense Trade Controls.

Unfortunately, as is discussed in more detail below, DCS data is incomplete, severely lacking in transparency, and presented in an extremely user-unfriendly fashion. WMEAT’s authors argue that the figures for DCS shipments in particular are a severe underestimate, as a) companies are not obliged to report all deliveries under DCS licenses and b) they exclude deliveries exempt from licensing, in particular to Canada. However, the WMEAT methodology, which assumes that all DCS equipment and service authorizations ultimately turn into deliveries over the course of their period of validity, gives what I consider to be a massive overestimate of US arms sales, for reasons discussed in greater detail below. (CRS, conversely, takes the approach of excluding DCS sales altogether due to the unreliability of official data, which certainly leads to an underestimate of US arms exports).

IHS Janes

The international defense-specialist publishing company, IHS Jane’s, estimated the total value of global arms deliveries in 2016 at $62.3 billion. Unfortunately, IHS data suffer from two main disadvantages: first, like the US sources, its methodology is not transparent. Secondly, and more importantly, you have to pay for it. (They also appear
to underestimate some of the European exporters, compared to the EU figures).

**National data**

In addition to these data sources with international coverage, many countries provide reports on their national arms exports, to a greater or lesser degree of comprehensiveness, from a press release with a total annual figure and some key customers, to detailed records of the value and type of equipment exported to each recipient.

As discussed, what information is collected will depend on a government’s interest in collecting it, and what is provided will depend on what they wish to communicate to their own citizens and the wider world (influenced also by the strength of demands for transparency from Parliament and civil society). There are three key types of information that may be collected and published by arms exporters, each with a different purpose: information on export licenses is mostly used for assessing the way in which export controls are being applied, but typically does not reflect well what is ultimately delivered (and in some cases does not even fulfill its primary goal, as discussed further below). Information on orders or transfers agreements gives a picture of a country’s relative success in the international arms market, and their arms trading relationships with individual partners and clients. Information on deliveries, which is what we are interested in, allows the best assessment of what military capabilities are actually being transferred when.

On the other side of the equation, few if any countries provide data on the level of their arms imports.

The international arms trade is dominated by a relatively small number of major exporters, which we will focus on in attempting to produce an estimate in the next section. Specifically, the top 20 exporters of major conventional weapons over the period 2012-15 accounted for 97.8% of the total trade, according to SIPRI data. These countries were:

1. USA
2. Russia
3. China
4. France
5. UK
6. Germany
7. Spain
8. Ukraine
9. Italy
10. Netherlands
11. Israel
12. Sweden
13. Canada
14. Switzerland
15. South Korea
16. Turkey
17. Norway
18. Belarus
19. South Africa
20. Finland

Of these, all apart from China and Belarus have provided at least some public data on the financial value of their arms exports in recent years. In addition, other EU member states (all except Greece, which has stopped providing data in recent years due to lack of governmental capacity) provide data on their arms export deliveries to the EU Annual Report. Serbia also provides data in its national report. Together, these countries account for another 1.1% of total transfers. While SIPRI figures do not correspond directly to financial values, it can be stated with very high confidence that these countries account also for the overwhelming majority of the financial value of the international arms trade.

Table one summarizes the information on arms exports provided by different countries:
Building an estimate

If we want to get a measure of the financial value of the international arms trade, in a way that can be verified or challenged based on open sources, it is necessary to do so piece by piece, by looking at the arms sales of the major exporters. SIPRI in fact does attempt to do this, providing an estimate for 2014 of at least $94.5 billion for its most recent figure. Below, I build an estimate based on the same principles as SIPRI, using national sources of data where available, but attempting to go into more detail with some particularly problematic countries, to produce reasonable estimates or ranges of estimates. Unfortunately, the “particularly problematic” countries include several of the top global arms exporters, including the number one, the USA.

The estimate will be an average for the period 2012-15, to attempt to smooth over annual fluctuations in deliveries by some countries, and in hopes of reducing the margin of error where deliveries must be estimated based on other data such as orders.

For those countries where data on deliveries is available, we can use this data directly. For several countries, however, most notably the UK, Germany, Israel and South Korea, it is necessary to estimate deliveries on the basis of other information. In the case of Belarus and China, in the absence of any publicly available official data, we must rely on other data providers, such as WMEAT, CRS or IHS, whose data is based on non-open sources.

We now go over the figures and estimates country by country. Data up to 2014 in most cases is obtained from SIPRI’s data on the financial value of states’ arms exports, which is compiled from national reports. Data for 2015, and for US DCS sales and some other cases, are from the relevant national reports, and from media reports as cited below.

3. Building an estimate

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USA

As discussed above, there are more than one category of US arms sales, and there are uncertainties in the data surrounding one of them in particular, namely Direct Commercial Sales. The bulk of this section therefore is devoted to attempting to understand and interpret the available data for DCS, and produce viable estimates based on these.

Foreign Military Sales (FMS): These are government-to-government arms sales agreement between the US and a foreign government, where the US government then contracts with a US producer to provide the equipment. Data on FMS agreements and deliveries are available annually from the Defense Security...
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Cooperation Agency (DSCA). Over the period 2012-15, FMS deliveries averaged **$15.2 billion** per year.

**Foreign Military Construction Sales (FMCS):** Similar to FMS, these are government-government agreements for the construction of military equipment and facilities, and are also reported by DSCA. Over the period 2012-15, these averaged around **$500 million** per year.

**Direct Commercial Sales (DCS):** These are sales made directly by US companies to foreign governments and entities, requiring a license in most cases from the US State Department. The State Department produces an annual section 655 report detailing the value of authorizations and shipments of defense equipment and services under DCS. The value of authorizations for each country is broken down into different categories of military equipment and services, with number of licenses and value in each category for each country. Data on shipments (deliveries), however, is limited to a total per country. Up to 2008, the DCS delivery figures are also reported in the DSCA Fiscal Year Series reports.

The CRS does not include data on DCS agreements and deliveries in its total for US arms exports, as it considers the data to be incomplete, and as the data is not revised and updated as is the case for FMS data. In particular, data on DCS authorizations is of limited value, as once a company has obtained a license for export with a 4-year validity, it is under no obligation to report whether or not a contract has resulted from this license, or the value of any such contract.

WMEAT's methodology assumes that all DCS authorizations, both for defense articles and for defense services agreements, ultimately turn into deliveries over the course of their validity. In addition to the fact that not all authorizations actually materialize as contracts and deliveries, an even more serious problem is that they include licenses for deliveries by US companies to US forces and government agencies stationed overseas. This gives rise to particularly high figures for countries such as Japan, South Korea, the UK, Germany, Belgium, Afghanistan and Iraq, which are host to a large US military presence. This is especially true for the authorizations for DCS agreements for defense services, which are frequently much larger than those for defense equipment, tending to range from $30 - $90 billion per year in recent years. In particular, the largest recipient of DCS service authorizations is “Various”, which likely refers to global military service contracts for US forces stationed overseas, such as the LOGCAP programs contracted to KBR and other major US military logistics companies. In general, for DCS authorizations, there is no way to distinguish between authorizations for actual exports to foreign governments, and those for contracts between US companies and US forces overseas. Authorizations data cannot be used therefore as a means of estimating actual exports to foreign clients. This creates a serious problem for the WMEAT methodology, and means that their figures for US arms exports are severe overestimates.

We are interested in deliveries, however, for which separate figures are provided, at least for defense equipment (articles); data for deliveries of defense services are not available, as no-one collects this data.

regarding deliveries based on DCS licenses, the CRS arms sales reports provide the following information:

“Annual commercially licensed arms deliveries data are obtained from shipper’s export documents and completed licenses from ports of exit by the U.S. Customs and Border Protection Agency which are then provided to the U.S. Census Bureau. The Census Bureau takes these arms export data, and, following a minimal review of them, submits them to the Directorate of Defense Trade Controls... which makes the final compilation of such data—details of which are not publicly available. Once compiled... these commercially licensed arms deliveries data are not revised.”

The major problem, however, is that companies only report deliveries once they have fully utilized a license, or once the license has expired. Since the vast majority of licenses are valid for 4 years—and since the data compiled by the DDTC and included in Section
655 reports are not revised—this means that only the deliveries made during the final fiscal year in which the license was used will ever be included in a Section 655 report.\(^3\)

In three years, however, 2005, 2006, and 2008, detailed and comprehensive shipment data for DCS was collected by the US Customs, and presented in the section 655 report.\(^4\) These years show far higher figures for total DCS deliveries, in each case over $30 billion, compared to a maximum of $8.9 billion in any other year for which figures are available, from 1971.\(^5\)

However, once again, these figures are inflated by the fact that DCS licenses, as well as covering exports to foreign governments and entities, also include deliveries by private companies to US forces and government agencies operating overseas. Indeed, as with authorizations, the largest recipients of DCS deliveries in 2005, 2006 and 2008 are mostly countries with a significant US troop presence and/or military bases, such as Japan, Germany, the UK, South Korea, Kuwait, and Italy.\(^6\) Moreover, in many cases (e.g. Japan and Iraq) the figures are completely implausible in relation to the country’s military spending.

However, it is not just countries with a large US military troop presence where delivery figures are higher in 2005, 2006 and 2008 than in other years. Indeed, comparing deliveries in these years with the average for 2004, 2007 and 2009,\(^7\) this is the case for 90 out of 105 countries with non-negligible levels of deliveries,\(^8\) and in 57 of these countries the ratio is at least 2:1.

Overall, for countries with significant levels of US forces and bases, the ratio of deliveries for 2005, 06 and 08 compared to 2004, 07 and 09, is 5.4:1, while the ratio for those without such a US presence is 2.7:1, still a very substantial difference. Leaving out Canada from the latter group, the ratio is still 1.7:1.

A particular consideration applies for Canada, in that many commercial defense exports from the US are exempt from licensing requirements. For Canada, the average level of DCS deliveries for 2005, 2006 and 2008 is $1.7 billion, but only $200 million for 2004, 2007 and 2009. As there are no US military bases in Canada, the large difference can be attributed to deliveries exempt from licensing requirements.

Thus, while the spike in the figures for 2005, 2006 and 2008 is particularly strong for countries with a substantial US military presence (and Canada), the fact that there is also a very substantial increase in these years for most other countries, strongly reinforces the suspicion that the figures in other years, being based on reporting by companies, is failing to capture the full extent of US arms exports under DCS. On the other hand, while it is likely that most or all deliveries to US forces have not been included in the figures for the other years, it is not possible to rule out that some such deliveries are included, which would further weaken the value of the DCS data.

Figure 1 shows annual DCS deliveries over time, from 1971-2015. The spike in 2005, 2006 and 2008 is clear, but there are also some quite erratic trends in the 1990s and early 2000s. It is not clear if this is due to a change in policy (e.g. in terms of preference for DCS vs

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\(^3\) WMEAT Sources and Methods, quoting State Department Congressional Budget Justifications.

\(^4\) This followed legislation from Congress in 2004 requiring more detailed reporting, which, however, seems to have been allowed to go unimplemented since 2008. The reason for the lack of such an exercise for 2007 is unclear.

\(^5\) WMEAT also use these figures as part of the basis of their very high estimates of US arms sales.

\(^6\) While there were until very recently no permanent US military bases in Israel, there are several so-called ‘lilypads’, small installations that may be staging posts for operations or temporary facilities. It is not clear if this accounts for the high volume of DCS to Israel.

\(^7\) The figures for 2010-2015 are somewhat lower than those for 2004, 07 and 09, both for countries with a large US military presence, and those without.

\(^8\) A total of at least $10 million over the period 2003-2015
FMS on the part of the US government or of key buyers), or simply to changes in reporting – the extent to which companies are bothering to report deliveries at the point of shipment.

Fortunately, more accurate data is available for some years. The General Accounting Office (GAO), carried out an analysis in 2010 where it systematically went through all records of DCS-licensed shipments contained in the Automatic Export System database from 2005-2009, stripping out deliveries to US forces overseas, and temporary exports (e.g. for demonstration to clients, or display at arms fairs), to obtain estimates for the level of actual, permanent exports in each year to foreign governments and entities. The figures they obtained were: $10.6 billion in 2005; $11.7 billion in 2006; $12.2 billion in 2007; $12.1 billion in 2008; and $13.3 billion in 2009.

These figures do NOT include $4.1 billion of equipment shipped to Canada over the period 2005-09 under license exemptions, for which it was not possible to distinguish between temporary and permanent exports. The report notes that DCS exports tend to be concentrated among developed countries, with the largest recipients over the period 2005-09 being Japan ($11.2 billion), the UK ($6.8 billion), South Korea ($4.1 billion), UAE ($3.6 billion), Israel ($2.7 billion), Australia ($2.1 billion), and Canada ($2.0 billion). Developing countries, and those receiving large amounts of US military aid, tend to use FMS to a greater degree. (Israel received $5.3 billion worth of equipment under FMS, presumably mostly coming from the portion funded by US military aid). The oil-rich Gulf states differed in their approach, in that while the UAE received most of its US arms through DCS, Saudi Arabia received the great majority through FMS, according to the report.

The figures for 2005, 2006 and 2008 are, as expected massively lower than the totals produced by Customs including all shipments under DCS licenses. On the other hand, the figures for 2007 and 2009 were significantly higher than the official figures produced under the point of shipment reporting system, of $8.9 billion and $5.2 billion respectively. This confirms the suspicion that this system leads to highly incomplete and underestimated data. The ratio between the GAO and the official figures is far higher in 2009, however: one may perhaps speculate that companies were reporting more assiduously in 2007, in the face of Congressional demands for more complete reporting, that had led to the US Customs figures in the surrounding years, but this is highly uncertain.

Some conclusions from this:
- In most years, the reporting system at the point of shipment for DCS deliveries leads to a substantial underestimate of US arms exports under DCS.
- In contrast, the 2005, 2006 and 2008 figures, based on a complete count by US customs of all given in the GAO report of $3.6 billion in total FMS and DCS licensed deliveries to Canada).

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9 The Canada figure is obtained by deducting the total of FMS deliveries to Canada reported by DSCA from the figure given in the GAO report of $3.6 billion in total FMS and DCS licensed deliveries to Canada).
deliveries of military equipment (including those under DCS licenses and license exemptions), are gross overestimates, due principally to the inclusion of deliveries to US forces and government agencies overseas.

- It seems likely that the degree of underestimation through the point of shipment reporting system is highly variable; this is apparent from the two years in which we have both the GAO estimate and the official data (2007 and 2009), but is also suggested by the extreme variability in official DCS delivery figures generally, compared to FMS; the fall in exports to well under $1 billion a year over 1999-2002, for example, seems very suspicious.

- As a result, it appears impossible to derive a meaningful estimate of actual US arms exports under DCS from the official figures, and certainly any meaningful trend information; there is no way to distinguish the 'signal' contained in these figures, of variations in actual deliveries, to the 'noise' of variations in reporting by companies.

This presents a dismal picture in terms of attempting to estimate the overall size of US arms exports on the basis of official DCS data: to apply some sort of ratio to estimate actual deliveries on the basis of the figures would be fruitless, as the appropriate ratio depends on the degree to which companies are bothering to report shipments, which appears to be highly variable.

The only hard data we have are the GAO estimates from 2005-2009, where they appear to have carried out a systematic analysis of deliveries to separate genuine exports from deliveries to US forces and temporary exports. This amounted to $12 billion a year. To attempt to assess how this may have changed, we can look at SIPRI data for US arms exports, which while it does not give a direct indication of financial trends, gives a good picture of the overall volume of exports, and of changes in patterns of major customers.

The average annual value of US arms exports, according to SIPRI's TIV measure, was 30% higher over the period 2012-15 than it was over 2005-09. However, the profile of customers changed: specifically, the volume of sales to developed countries, as well as the UAE, which tended to get most of their US arms through DCS, barely changed, while the volume from developing countries accounted for essentially the whole increase. In particular, sales to Saudi Arabia increased more than six-fold. I examined SIPRI's internal database, looking at all US arms deliveries over the two periods, 2005-09, and 2012-15, and identifying those which were, or were most likely, DCS sales. The result was that, over the period 2005-09, DCS sales averaged a TIV value of 3285 per year, or 46% of the total for US arms deliveries. Over the period 2012-2015, this declined to an average annual TIV of 2816, a decline of 14%, and only 30% of the total TIV value of US deliveries for the period.

Against this decline, we may note that there has been some inflation between the two periods (with military cost inflation likely at least as high). Overall, it would appear from this analysis of SIPRI data that the volume of DCS arms deliveries has probably not changed substantially in either direction. Given the uncertainty, I would suggest figures of $9 - $15 billion

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10 Only a small number of sales are specifically identified as DCS. However, FMS sales tend to be identified either directly as FMS, or through the fact that sales are announced by the US DOD, or by the presence of DSCA notifications to Congress. Some DCS sales can also be definitively identified as such by the fact that a contract is signed between a US company and the recipient country (as opposed to between the DOD and a company, and/or the DOD and the recipient). Other categories of non-DCS arms transfers include those provided directly as military aid, and those sold from US military stocks under the Excess Defense Articles Program. I have assumed that those transfers that are not identified as FMS, EDA, or military aid, are likely to be DCS. While it is likely that there has been some misidentification of individual transfers, this approach should get a fairly reliable picture of the approximate level of DCS sales, according to SIPRI's TIV measure, especially as the transfers that are not definitively identified tend to be small.

(footnote continued)
as a reasonable range of estimates for DCS licensed sales per year (compared with an average of $4.4 billion in the official figures).\textsuperscript{11}

As this is a comparison with the GAO figures, which do not include sales to Canada (and potentially other countries, to a lesser extent) under license exemptions, I will include an additional $1 billion a year to account for such sales, for a total of \textbf{\$10-16 billion} per year.

This does not take account of DCS services exports, whereas noted there is no data for deliveries, only for authorizations. Such services include, according to the GAO report, “logistical support, repairs, training, and technical assistance”.

Unfortunately, there is no basis on which to make a viable estimate for these. The authorizations data is particularly useless in this regard for several reasons:

i) The large proportion of such authorizations that are for services provided to US forces overseas, as such maintenance and logistic services are overwhelmingly outsourced to the private sector;

ii) Authorizations may cover a 10-year period, rather than 4-year, according to the GAO report, with the value of services exported often lower than what is authorized;

iii) The section 655 reports state, in relation to service agreements, (e.g. in the 2016 report) “Export authorizations furnished in FY 2016 also include certain activities occurring in prior years because the scope of the Department's regulatory authority over such agreements continues for as long as these multi-year agreements remain in effect.” The interpretation of this is not clear, but it may mean that the value of authorizations reported in each year is the total value of authorizations for all agreements that are still in operation; this would imply that, rather than each authorization being counted only in the year it is granted, they are counted towards the total for each year for which they apply.

The GAO report notes that deliveries of services are reported for FMS exports, and that they typically constitute about one third of the total value of FMS exports. However, given the already substantial uncertainty regarding the level of exports of DCS equipment, any estimate based on this piece of information would be tenuous in the extreme. Almost certainly, such DCS service exports are non-zero: the export of equipment is frequently accompanied by the provision of long-term maintenance, repair and overhaul (MRO) services, as well as training in the use of the equipment, technical assistance, etc. On the other hand, it is possible that the developed countries that most use DCS exports are more likely to contract with their domestic arms industries for MRO.

Hence, any attempt at an estimate, or even a range of estimates, based on the available information, would be tenuous in the extreme. Thus, there is an entire area of US companies’ business with and support for foreign militaries that is completely non-transparent, deliveries, although the actual transfer of technology would have taken place a long time before. Such cases are more prevalent in the 2005-09 period; taking account of this would lead to a relative decrease in the 2005-09 figures compared to 2012-2015, thus possibly increasing the range of estimates for 2012-2015 somewhat. The change would not be large, however.

\textsuperscript{11} One potentially complicating factor in this analysis is those cases involving licensed production by the recipient country of US weapons systems. This can range from the final assembly of systems from kits provided by the manufacturer, to full production in the recipient country using designs and technology provided by the US manufacturer. In some cases, contracts signed in the 1980s or 1990s are still resulting in production in the recipient country, which is recorded in the SIPRI database as new
How Big is the International Arms Trade?

Russia

Figures for deliveries of arms for export are regularly made by the Russian Federal Service for Military and Technical Cooperation and by state arms export agency Rosoboronexport, although no formal annual report is produced. The Center for the Analysis of Strategic Technologies (CAST) provides a compilation of the figures in these announcements, supplemented in some cases with their own estimates. It is not possible to assess the reliability of these figures, given that virtually no detail is provided (sometimes the top recipients are announced, though not always with specific numbers per country), and it is possible that figures are exaggerated by the Russian government to boost the image of their arms industry. However, they are the only official, open source figures we have to go on.

According to these figures, the average value of Russian arms export deliveries between 2012-15 was $15 billion per year. The apparent precision of this figure, compared to the considerable uncertainty described for the US, is deceptive, resulting only from the fact that we know nothing about how the data is produced, what it does and does not include, and what anomalies might be discovered were one able to examine the data in the detail available for the US.

The United Kingdom

The UK is a surprisingly problematic case, in that the UK government does not make any reporting of arms export deliveries, to the EU Annual Report or otherwise. It reports only the value of export licenses to the EU report. Separately, the Department of Trade and Industry reports the total value of defence export orders each year.

Data on UK export licenses, as reported in the EU Annual Report, covers only ‘single’ export licenses, covering a single delivery of specified equipment to a specified country. A large proportion of UK arms exports are made through ‘open’ export licenses, which allow for multiple deliveries of specified equipment, or of a whole category of equipment, to a specified country, over a period of time. Therefore, UK export license data greatly understates the value of the UK arms trade. Licensing data cannot therefore be used to produce a meaningful estimate.

The data on orders is therefore probably the best basis on which to make an estimate, although the lack of detail is troubling; the total per year is broken down by region and by category of equipment, but not by individual recipient.

By far the UK’s largest arms export customer is Saudi Arabia, through a series of huge government-to-government contracts, Al-Yamamah (negotiated in the 1980s), Al Yamamah 2 (1990s), and Al-Salam (2000s). The prime contractor for these agreements is BAE Systems. Fortunately, the annual figures for defence export contracts includes only claims made in the given year under these large ongoing deals, rather than including the total value in the year they are signed and nothing in other years.

Nonetheless, the major problem in estimating deliveries on the basis of orders is that the time between order and delivery is immensely variable, depending on the type of equipment and other factors. The clearest and longest data on orders and deliveries is provided by the US Foreign Military Sales figures, from 1970 onwards, as shown in figure 2 below. While we cannot be certain that a similar relationship exists for the UK, it is the best comparator available.

Trends in deliveries clearly lag those in orders. Experimenting with different options, we find that a 5-year moving average of orders, lagged by one year (so the average of orders from 1 to 5 years ago) gives a graph that, until recently, tracks the figures for deliveries fairly well (see figure 3). A 4-year lag gives an even better correlation. In recent years, however, orders have massively outpaced deliveries; this is largely due to several very large contracts for F-35 Joint Strike Fighters, made from 2007-2010, which have only just begun to see the first deliveries.

Looking at long-term US figures, and excluding the most recent years where the orders have only barely
begun to see deliveries, I estimate that about 86% of total order value eventually turns into deliveries. I assume that a similar ratio applies for UK arms exports.

- 14% of the value of orders in each year never lead to deliveries
- 30% of the value of orders are delivered in the same year, mostly representing the value of claims made against large ongoing government-to-government contracts, chiefly with Saudi Arabia
- The remaining order value each year is delivered over the following 12 years, roughly in proportion to the delivery rates derived from the analysis of the SIPRI transfer records. The delivery rate tails off in the last few years.

Based on this, I obtain a rough estimate for average UK annual arms sales between 2012-15 of $9.7 billion per year. By contrast, the average value of orders in these years was $13.7 billion. However, the delivery estimates are influenced by the lower volume of orders in the years prior to the period in question.

However, these estimates are subject to considerable uncertainty. I therefore allow for a range of estimates of $8.5 - 11 billion per year, to allow for a reasonable margin for error in these estimates. Essentially, if a higher proportion of the total ultimately leads to deliveries, or is delivered in the same year as the order or shortly afterwards, a higher figure results, and vice versa.

**France, Italy, Spain, Sweden, and other EU countries**

With the exception of the UK, Germany, Belgium, Ireland and Greece, all these countries provide data for deliveries to the EU Annual Report. The annual average for these EU member states for 2012-15 among these was:

- France: $5.3 billion
- Spain: $4.0 billion
- Italy: $3.9 billion
- Sweden: $1.3 billion
- Others: $3.4 billion
It should be noted that the EU Common Position on arms exports, on which the reporting in the EU Annual Report is based, covers “exports of military technology and equipment”. This includes “technical assistance”, in the ML22 category of “technology” in the EU Common Military List, in turn including “instruction, skills, training, working knowledge, consulting services”. This therefore does not include e.g. MRO services performed in the recipient country. For total EU arms export licenses (delivery figures are not available for many important countries), the ML22 category accounted for 3.2% of the total value in 2015, suggesting that this only covers a narrow range of military services.

**Germany**

Germany does not report arms export deliveries to the EU Annual Report, but only license values. However, in their [national arms exports report](#), they do report deliveries of a subcategory of arms exports, “weapons of war” (Kriegswaffen). This includes what is often described as “lethal” military equipment, but not e.g. engines, radars, communications systems, and other subsystems and equipment. They also provide a figure for the value of (individual) licenses for weapons of war.

Moreover, the national report, as well as giving figures for individual export licenses, as reported in the EU Annual Report, also gives figures for the value of “collective” export licenses, which are a type of ‘open’ license that allows for multiple deliveries to various recipients over a longer period of time, as part of collective defense projects, usually with other EU or NATO states.

Based on the relative size of the figures for deliveries of weapons of war (WoW), and of the individual license values for weapons of war, it is clear that at least some of the deliveries of WoW occur under collective licenses. This follows from the fact that the value of WoW deliveries actually exceeds the value of WoW individual licenses over a long period of time, and weapons cannot be delivered unless they are previously licensed.

To estimate total German deliveries, I have made two somewhat heroic assumptions: first, that the proportion of collective licenses that are for weapons of war is the same as the proportion of individual licenses. This allows us to estimate a total license value for WoW, including both individual and collective licenses. Secondly, I assume that the ratio of licenses to deliveries for all military equipment is the same as that for WoW. This gives a ratio of 1.45:1 for licenses to deliveries. Finally, I average the value of collective licenses over the current and previous years, as these are valid for 2 years, whereas individual licenses are only valid for one.

These assumptions result in an average annual figure for German arms export deliveries of **$7.8 billion per year**. To allow for the significant margin of error in this calculation, I assume a range of **$6.5 – 9 billion**.

**Belgium**

Belgium only reports license values, and not deliveries, in the EU Annual Report. However, in Belgium, arms export licensing is mostly devolved to its component regions of Flanders, Wallonia and Brussels, which each produce their own [annual reports](#). Only equipment exported by the Belgium armed forces is licensed at a federal level. Wallonia accounts for the great majority of Belgium arms exports, and fortunately the Wallonian annual report does report deliveries as well as licenses. For the remaining Belgian exports, I assume the same ratio of licenses to deliveries as applies for Wallonia. This

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12 With an adjustment for the fact that Wallonian license values are massively inflated in 2014 by one single contract with Canada for gun turrets for use on armored vehicles sold by Canada to Saudi Arabia. This contract, and the associated license, lasts for 15 years. I prorated the value of the license over 15 years to account for this. But since the value of licenses by the other regions is small, this does not make a great deal of difference to the total.
results in an estimate of around $600 million a year for Belgium.

**Ireland**

Ireland also only reports license values and not deliveries. They did report deliveries in the past, however, so I have assumed the same average licenses to deliveries ratio as applied in the past. The numbers in any case are very small.

**Greece**

Owing to the Greek financial and economic crisis, Greek governmental capacity has been significantly constrained in recent years, resulting in a failure to provide any information on arms exports. Hence Greece goes into the category of countries for which we do not have any data.

**Israel**

The Israeli government only provides data on arms export orders, and not deliveries. These are generally presented in media statements, and are not accompanied by a detailed report. Delivery figures provided in the past (up to 2011) suggest that, in general, most orders eventually lead to deliveries. I have assumed an eventual delivery rate of 90%, somewhat conservatively. As with the UK, I looked at actual equipment ordered from and delivered by Israel, with orders over the period 2000-2007, and thus derived a rough ‘schedule’ for the rate at which orders are delivered over subsequent years.

Based on this approach, I obtained an annual average level of deliveries for Israel from 2012-15 of $5.6 billion per year, and thus estimated a range of $4.6 - 6.6 billion.

**China**

China does not release any data on the value of its arms exports, and the value of individual deals is rarely reported either by China or by their customers. For China, therefore, I looked at estimates from other sources. IHS Jane's provides an estimate for 2015 of $1.5 billion. CRS gives an estimate of $2.4 billion per year for 2012-15. WMEAT's figures agree with CRS for the period 2012-2014, and are very similar for the period 2008-2011. In the absence of better data, I have assumed a range for China of $1.5 - $2.5 billion a year.

**South Korea**

South Korea is another country that provides only order data. The case of South Korea is more difficult than the UK and Israel, as the annual volume of orders has increased dramatically in recent years, from an average of $250 million a year from 2001 to 2006, to a little over $1 billion a year for 2007-10, then $2.4 billion a year for 2010-11, and about $3.5 billion a year from 2013-2015. The level of orders for the UK and Israel has been much steadier. Moreover, the amount of actual deliveries of major conventional weapons recorded in the SIPRI database is rather limited, so it is not so easy to obtain a typical delivery profile for South Korean orders.

I have estimated a fairly wide range therefore for South Korea's annual deliveries for 2012-15, of $0.6 - 1.6 billion. The lower end of the range is more compatible with WMEAT's estimates, whereas the higher end would assume that some of the large orders made in recent years have begun to result in significant deliveries.

Ukraine, Turkey, Switzerland, Norway and Serbia all provide delivery figures, at least in most years. The averages for Turkey, Switzerland, Norway and Serbia for 2012-15 are $1.5 billion, $600 million, $600 million, and $200 million respectively. For Ukraine, there is missing data for 2013, so the estimate is based on 2012, 2014 and 2015, for an average of $660 million per year, with a range of $550-750 million to allow for uncertainty.

Canada provides annual data on arms exports by country and category of equipment. However, as most exports of military equipment to the US are exempt from licensing requirements, these are not included in the total. The average for the period 2012-15 is US$738 million. As a rough estimate, to account for
deliveries to the US, I double this figure, but allow for a fairly wide range of estimates from **$1-2 billion**.

**South Africa** only provides license data. I have assumed a ratio of 2:1 for licenses to deliveries, giving a figure of **$260 million** a year.

For **Belarus** there is no publicly available data. WMEAT estimates an average of around **$200 million** a year for 2011-14, the most recent available 4-year period, which we will use.

**All other countries**

The countries listed above, for which figures are available or for which estimates have been made, account for 98.9% of all transfers of major conventional weapons over the period 2012-15, according to SIPRI TIV data. I have assumed that the financial value of the remaining countries' deliveries are in proportion to their TIV value, for an estimate of **$1.1 billion per year** for all other countries combined, with a range of **$600 – 1600 million** to allow for the considerable uncertainty in the estimate.

**GRAND TOTAL**

Adding up all the above estimates gives a grand total estimate of around **$95 billion a year** as the total financial value of the global arms trade (with rounding), or a probable range of **$86 billion - $104 billion** to allow for the very considerable uncertainties in many of the estimates. SIPRI's estimate of at least $94.5 billion in 2014 is comparable.

This total, however, excludes exports of military services by the US through the Direct Commercial Sales program, which almost certainly run into the billions of dollars, as well as most military services from most EU countries, and possibly from others. It includes service exports by the US through FMS, from the UK, from Norway (which reports service exports separately from equipment), “Technical Assistance” services from other EU countries, and possibly services from other non-European suppliers. For countries where we have estimated exports based on orders, however (Israel, South Korea), it may be reasonably presumed that the reported value of these orders includes associated services. The fact that FMS exports (according to the GAO, for 2005-09) account for one third of the FMF total does not provide any guide to the situation in other countries. For Norway, for example, export of services only accounts for 7% of total arms exports. Hence, it is not possible to make a meaningful estimate of the amount of ‘missing’ military services from these figures. Very cautiously, I would venture that they run into the low tens of billions.

**4. Reflections and conclusions**

The discussion above shows that the quality of financial data on the international arms trade is extremely poor. Countries that one might associate with high levels of transparency, including the USA, UK and Germany, fail to provide adequate data on their arms exports, even at a most basic aggregate level. The USA purports to provide such data, but on closer inspection, the data for Direct Commercial Sales exports is severely flawed and incomplete. The UK provides data on export orders, whose correspondence with actual exports is unclear, and on licenses, which fails to cover a large proportion of UK exports. Germany provides data on the exports of “weapons of war”, but only license data for other military equipment.

The fact that US DCS data crumbles under closer analysis may call into question the accuracy of apparently straightforward data from other countries. Most EU countries, for example, provide data on deliveries to the EU Annual Report, but how certain can we be of the comprehensiveness of this data? One feature of EU arms export data that is difficult to interpret is the fact that, for countries that do report both licenses and deliveries, the long-term ratio between the two is highly variable. License totals are almost always high in the long run than deliveries, as one would expect, as not all licenses are used; but the ratio for individual countries ranges from around 1:1
for Sweden to around 10:1 for Hungary, with typical values generally in the range 1.5 – 2.5.

One possible interpretation of this is that these differences relate to differences in countries’ export licensing systems: for example, to what extent do countries make use of “open” licenses, which allow for multiple deliveries to one or more customer, and are values (or estimated values) of open licenses included in license totals? (They are not for the UK, for example). Some brief enquiries by SIPRI to export control officers in a number of EU states in 2016, however, did not find any evidence to support this, although the response rate was low. Another possibility that comes to mind, however, in the light of the DCS data, is that the differences may relate instead to the completeness of reporting of deliveries. Reporting of deliveries for EU member states is based on companies’ reports of licenses used, either on a rolling basis (at the point of use), or an annual or quarterly basis. However, how rigorously companies ensure that they report all licenses used, and the extent to which national export control authorities check up on these reports, is unclear. It is possible, therefore, that the reason for some countries having particularly high license to delivery ratios is that company reporting of license use is incomplete, which would mean that the delivery figures are in fact significant underestimates. Fortunately, the countries with such high ratios are not among the major European arms exporters. Nonetheless, incompleteness of data for some of the major countries cannot be ruled out.

The treatment of defense services is another area where there is inconsistency. As noted in the discussion of the US, the data for the US includes services for FMS, but not for DCS. UK data on arms export orders, on which the above estimates for actual UK exports are based, do include services. For other EU countries, where the delivery data is based on the export licensing system, technical assistance is included, but other services such as repairs, maintenance, and logistics, are not covered. For most other countries, it is not clear whether services are included in the available data.

In conclusion, this exercise of attempting to estimate the total financial value of the legal international arms trade, has underlined the abysmally poor quality of data for most countries. Official data for the world’s largest arms exporter, the USA, is incomplete and significantly underestimated, except in the few years from 2005-09 for which the General Accounting Office has made a more rigorous analysis. UK and German delivery figures must be estimated from orders or licenses, Russian figures are apparently clear but the complete lack of detail raises questions as to their reliability. China provides no data at all, leaving guesstimates as the only option. As a result, the estimated range produced in this article, from $86-103 billion, is rather wide, and even so excludes an unknown (and impossible to meaningfully estimate) quantity of service exports. This strengthens the case for using instead a volume/equivalent-value base metric for measuring the arms trade, as used by SIPRI, although of course the absence of a clear picture of the financial value of the trade remains frustrating.

The position looks even worse if we attempt to break down figures by recipient. Russia provides no such breakdown, although figures for the two or three largest recipients are sometimes given. The UK only breaks down military orders by region, not individual country, as does Israel; while UK license data is broken down by country, as discussed this excludes a large proportion of UK arms exports that takes place under ‘open’ licenses. Of the major arms exporters, only France, Spain, and Italy provide (apparently) comprehensive annual data on exports to each recipient.

The state of transparency in the international arms trade is, thus, very poor. While various US government agencies, in particular the GAO and CRS, have argued that it is in the interests of the government and legislators to have more comprehensive and reliable information on what is often considered a key instrument of foreign and defense policy, it appears that such arguments are not convincing to many governments. This likely reflects the interests of the arms industry, who would prefer to avoid both the administrative burden of reporting, and excessive public scrutiny of their activities.