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Preliminary Economic Assessment

(Prepared by Warwick Economics and Associates)

1. During the first session of the Committee of Governmental Experts for the preparation of a draft Protocol to the Convention on International Interests in Mobile Equipment on Matters specific to Agricultural, Construction and Mining Equipment (Rome, 20 – 24 March 2017), several participating States noted their interest in a revised *ex ante* economic impact analysis being conducted for the MAC Protocol.
2. The UNIDROIT Secretariat conducted a competitive closed tender process to select an independent entity to undertake the economic impact assessment. Following the process, the UNIDROIT Secretariat commissioned Warwick Economics and Associates to carry out the project. The economic assessment project is supported financially by the MAC Working Group.
3. Due to the short period between the first and second sessions of the Committee of Governmental Experts, it was not possible for a full and comprehensive economic analysis to be completed. This document contains the preliminary economic assessment report prepared by Warwick Economics and Associates. The preliminary report is currently available only in English. The final report will be completed towards the end of 2017.
4. To explain their initial findings, Warwick Economics and Associates will be present at the second session of the Committee of Governmental Experts.

**An Economic Assessment of the Fourth Protocol to the Convention on
International Interests on Mobile Equipment on Matters Specific to
Agricultural, Construction and Mining Equipment (the “MAC Protocol”)**

A Preliminary Report to UNIDROIT by Warwick Economics and Associates

28 September 2017

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Note:
All monetary figures quoted in this report are in US dollars unless otherwise stated

Executive summary

Why is MAC equipment so important?

i. Mining, Agriculture and Construction (MAC) equipment is hugely important, accounting for \$100 billion a year of world trade. It is a huge employer, source of profit and earner of foreign exchange. It enables economic growth and development in critical sectors of the world economy. The MAC sectors operate with less capital equipment in countries with poorer access to credit. This constrains productivity, profits and economic growth.

What will the MAC protocol do?

ii. The MAC protocol aims to address this by increasing the supply of secured finance for MAC equipment supplied across borders. It does so by making it quicker, easier and cheaper to recover assets in the event of default or bankruptcy and to move them to another country for sale.

iii. Our Theory of Change model aims to explain the interactions between the product market (MAC equipment) and the credit market (finance to buy MAC equipment). The chain of causality and likely responses are mapped out and specified to allow deeper consideration and, where data is available, quantification of impacts.

iv. The model considers how a given reduction in exposure to credit risk may feed through to a reduction in the cost of credit and an increase in its supply. By taking account of “real world” constraints and highlighting critical issues in the channels of impact, it helps inform an assessment of the impact. Is there a switch from unsecured to secured lending? What is the likely impact on the cost of credit? What happens if credit availability improves? How much does demand for MAC equipment increase? Do suppliers increase production or do they increase prices? Is the experience uniform across sectors and markets?

Is the protocol worth the cost?

v. The costs of implementing the MAC protocol are likely to be very low, relative to the cost of MAC equipment, based on experience in the aircraft sector.

How big are the benefits?

vi. Our study is still in progress and the analysis is not yet complete, so we do not have our own estimates of benefits yet, but given the size of the sector, even very modest improvements will generate hundreds of millions of dollars, and possibly billions, in benefits.

vii. The CEAL study (2013) estimated global benefit at \$3 trillion (\$3,000 billion) is over 7 to 10 years. Replicating the CEAL analysis with updated and more realistic assumptions cuts this figure to \$32 – 48 billion annually for developing countries and \$36 - \$50 billion annually for developed countries.

viii. We expect our analytical framework will yield substantially lower benefits figures, because of the additional “real world” constraints we will apply. However, they will be large in absolute terms and vastly greater than the costs of implementing the protocol.

1. Introduction

Background and context

1.1 The Cape Town Convention on International Interests in Mobile Equipment is a private international law treaty intended to provide a uniform set of rules applicable to transactions involving high value assets that can move across international borders. The treaty has created international standards for the registration of interests arising out of security agreements, leases and conditional sales contracts. It has also created various legal remedies for default under these agreements, including repossession and the effect of particular states' bankruptcy laws. The treaty was negotiated under the auspices of the International Institute for the Unification of Private Law (UNIDROIT).

1.2 Three protocols to the convention have already been developed, specific to three types of movable equipment: aircraft equipment (signed in 2001), railway rolling stock (2007) and space assets (2012).

1.3 The convention with the protocols is expected to have a positive net impact on equipment financing by reducing the risk of debt finance and increasing its availability. The convention facilitates the use of mobile capital equipment as high quality security against loans where national laws would otherwise preclude its use as collateral.

1.4 UNIDROIT is now considering the introduction of a fourth protocol that would facilitate the use of high value mining, agricultural and construction (MAC) equipment as collateral for loans and in leasing transactions. The aim of the 'MAC protocol' is to reduce the cost and increase the availability of credit for the lease or purchase of mobile equipment for use in these sectors, most notably in the countries with legal systems that currently preclude its acquisition or make it more costly.

1.5 Legal negotiations on the new protocol have made considerable progress and the core principles of the agreement have been considered carefully. In March 2017, countries involved in the negotiation of the MAC protocol requested that UNIDROIT commission an independent assessment of the potential global economic impact of the MAC protocol, to help them understand the costs and benefits of adopting and ratifying the agreement

Project scope and objectives

1.6 UNIDROIT requires an assessment of the likely scale and main channels of economic impact of the MAC protocol on member countries to inform and assist their ongoing discussions. A preliminary appraisal of global impact has already been undertaken by CEAL (the Center for the Economic Analysis of Law) providing valuable insights (Fleisig, 2013). However, the intended scope of the draft protocol has since evolved and further work is now required to refine the assessment of the potential impact of the protocol on the global credit and products market for MAC equipment and the economies of member states. The paper refers to the impact on UNIDROIT members and data is for current UNIDROIT members unless otherwise stated.

1.7 The current project has the following objectives:

- The development and demonstration of a robust and evidence based assessment framework that reflects best practice and is capable of being widely adopted and applied across member countries.
- Where appropriate, to review and build on the work already undertaken by CEAL.
- To identify the various ways in which the MAC protocol will have an effect and, where feasible, help UNIDROIT and its members consider how its impacts might vary between countries and markets and over time.
- To help UNIDROIT build its evidence base to demonstrate to members and non-members the effect of potential reforms before and after their adoption.
- To assist the second session of the Committee of Governmental Experts (Rome, 2-5 October 2017) by providing an overview of the key issues that need to be considered, initial findings and options for further work.

1.8 Warwick Economics and Associates have been commissioned to deliver these objectives. The team comprising Ken Warwick (Warwick Economics and project lead), Peter Dodd (Vital Economics) and Brian Titley (Brian Titley Consulting Ltd) combines over 90 years of professional experience developing economic impact assessments and assessment methodologies and addressing complex economic issues and policy options.

1.9 The project objectives are intended to complement the legal analysis and expertise already deployed considering the impact of the MAC protocol.

Progress to date

1.10 The current project consists of three stages:



1.11 Phases 1 and 2 were completed between August and September 2017. This preliminary report outlines the initial findings. A further report will be available towards the end of 2017 following completion of phase 3.

2. The MAC protocol: key legal changes, objectives and costs

The Cape Town Convention

2.1 By reducing the risk of debt finance and increasing its availability, the MAC protocol is expected to increase sales of MAC equipment, most notably to those countries that have not yet modernised their secured transactions laws and where equipment needs currently exceed availability due to finance constraints.

2.2 According to Goode (2002), the Cape Town Convention (CTC) should “provide lenders greater confidence in their decisions to extend credit, enhance the credit rating of equipment receivables, and reduce the borrowing costs to the advantage of all interested parties”. It operates by providing a clear framework for asset-based financing for mobile equipment. Specifically, the convention facilitates the use of mobile capital equipment as high-quality collateral against loans where national laws would otherwise preclude its use as security.

2.3 Key to its success is the convention’s ability to provide legal certainty for creditors, especially in cross-border transactions. The legal problem it addresses is that a security interest in mobile equipment perfected under the law of origin cannot guarantee effectiveness in other jurisdictions to which the asset may be relocated. The widely adopted principle associated with tangible movables (*lex rei sitae*) is that the applicable law will be the law where the property is situated. This principle is not well suited to equipment that moves from one jurisdiction to another in the course of its regular operation, such as aircraft, railway rolling stock or MAC equipment. The CTC aims to address this.

How is greater certainty achieved?

2.4 The CTC promotes greater legal certainty in international asset-backed financing because it provides for¹:

- The creation of a right that secures the obligation owed to the creditor, known as an international interest, which enjoys cross-border effectiveness.
- The creation of a 'prospective international interest', a mechanism that allows a creditor to register a potential interest during loan negotiations in order to secure priority for the eventual international interest should the loan transaction be concluded.
- An online International Registry for the registration of actual and potential international interests. Provided the debtor is located in a country that has ratified the CTC, a registered international interest created under the MAC protocol will be effective and have priority against existing security interests under domestic law or any subsequently registered international interests.

¹ The list is based on Mooney et al (2016)

- Specifically, the granting of priority to a registered international interest in the form of the ability of the secured creditor to satisfy its obligation ahead of competing claims in the case of the debtor's default. The convention also makes provision for agreeing how default should be determined.
- A set of remedies that the creditor can exercise in the event of a default by the debtor. The CTC and MAC protocol contain provisions allowing the creditor to obtain relief pending final determination of a claim and also require countries to specify whether a creditor must apply to a court to exercise a remedy or can exercise "self-help" in enforcing their rights.
- An agreement on how international interests should be protected in the event of a debtor's insolvency. Article 30 of the CTC provides that an international interest is effective where it was properly registered prior to the commencement of the insolvency proceedings. Accordingly, the insolvency administrator may not challenge the effectiveness of the international interest on the grounds that the creditor has not satisfied all of the requirements applicable to a comparable interest under the domestic law. More detail is set out in relevant protocols.

The relationship between the MAC protocol and general secured transactions laws

2.5 Protocols have already been agreed for aircraft, space and railway rolling stock. The MAC protocol, however, differs from the other three in its relationship to general secured transactions laws. In particular, Mooney et al (2016) point out that aircraft, space, and railway rolling stock assets are often excluded from general secured transactions laws or subject to special provisions or other laws that affect the operation of perfection mechanisms for the sector, such as registration in an aircraft registry. In contrast, MAC equipment is generally subject to secured transactions laws in the same fashion as for other assets. As a result, the interaction between the MAC protocol and the general secured transactions law will be much closer than in the case of the other three protocols.

2.6 There are a number of ways in which gains arise as a result of the legal reforms entailed in the MAC protocol. Foreign lenders, including banks and the finance companies of major manufacturers, incur significant costs when they have to investigate the domestic secured transactions law of every country in which they contemplate financing. If the MAC protocol results in a legal system for the relevant assets that is predictable and uniformly applicable, it will substantially reduce the costs of due diligence, thereby reducing the cost of credit and improving its availability. In addition to the gains from harmonising with international standards, there will also be significant benefits from accelerating the reform of general secured transactions laws and creating a framework that is more cost-efficient and more protective of creditors' rights.

Insolvency arrangements in the MAC protocol

2.7 Consistent with the previous CTC protocols, the MAC protocol allows Contracting States a number of options in terms of insolvency remedies. Article X of the draft MAC protocol allows Contracting States to apply one of three rules (Alternatives A, B and C) in determining creditors' remedial rights in the event of a debtor's insolvency. Alternative A is generally considered to give creditors holding an international interest the highest level of protection in the case of insolvency. As such, it is an additional mechanism likely to lower borrowing costs by reducing debt finance risks.

2.8 It is noteworthy that, of the 67 Contracting States to the Aircraft protocol, almost all have applied Alternative A. Moreover, the OECD Aircraft Sector Understanding on Export Credits (OECD, 2011) provides that Contracting States can benefit from lower export bank premium rates if they ratify the CTC and Aircraft protocol, provided they make certain declarations, including adopting Alternative A in relation to insolvency remedies. Although the MAC protocol cannot necessarily be assumed to result in comparable discounts, it shows that the OECD recognises the substantive impact of the CTC, including its insolvency provisions, in reducing risk.

Scope of international and domestic impacts

2.9 The legal changes from improving and aligning secured transactions laws as they affect MAC equipment will typically mainly affect finance and trade arrangements between suppliers in OECD economies and buyers in developing economies. It is in these trades that the greater legal certainty provided by the MAC protocol will have the most impact on the cost and availability of credit and therefore the likely response in terms of equipment sales and trade.

2.10 There are, however, potential gains from improvements within developing countries as well. If one of the mechanisms by which the MAC protocol improves credit conditions is by accelerating the reform of general secured transactions laws, then asset-backed transactions within countries could benefit as well. By default, the convention applies to domestic transactions unless a country declares otherwise. China, a significant manufacturer and purchaser of MAC equipment, is the most noteworthy participant to have made such a declaration. The impact of the MAC reform in countries such as China will therefore only be on transactions with an international element (ie where the supplier, buyer or financier is based abroad). However, only four of the 74 CTC Contracting States have made such a declaration relating to domestic transactions.²

² <http://www.unidroit.org/english/conventions/mobile-equipment/depositaryfunction/declarations/capetownconv-aircraftprot-decltable-matrix.pdf>

2.11 There is also a question of whether the MAC reform will have an effect in the more advanced OECD countries. There could be significant effects if the provisions of the CTC on insolvency law take effect, and in particular if countries adopt Alternative A, where the banks have indicated that they may be prepared to give a discount on the cost of finance. This will be explored in more detail in phase 3 of the study.

2.12 One initial criticism of the proposal for a MAC protocol was that it would be impossible to determine its scope because of the heterogeneity of the equipment involved. This has been overcome through the use of the HS classification system³ and careful identification of the applicable HS codes. The MAC Study Group (UNIDROIT, 2016) has also considered and suggested the inclusion of a number of innovative and flexible provisions, primarily those dealing with the relationship between an international interest in a MAC asset and a domestic law interest arising out of immovable property law.

Costs of the protocol implementation

2.13 Detailed analysis of implementation costs of the MAC registry lies outside of the scope of this study. However, there is enough information available to make some preliminary observations. A more detailed analysis of costs will be needed before a fully informed cost benefit assessment of the MAC protocol can be made. This will depend on the exact form of the MAC registration scheme, but the consensus is that the likely scale of costs is modest.

2.14 There are 4 main groups of direct costs:

- (i) set-up and operational costs;
- (ii) costs to governments in assessing the case for reform, negotiating internationally and implementing domestically.
- (iii) compliance and access costs; and
- (iv) Costs of transition / adjustment.

Set-up and operational costs

2.15 UNIDROIT has the great advantage of prior experience in implementing a registration scheme for aircraft. The costs associated with administering the aircraft protocol are known. Set-up costs for the Registry were \$2.12m. Annual operating costs are significantly less than annual revenue⁴ from registrations (\$1.88m) and searches (\$2.32m). The Registry has accumulated a surplus of around \$6m. These figures give a starting point for assessing the likely costs and possible revenues for the MAC registry.

³ The Harmonized Commodity Description and Coding System (HS System) is used by more than 200 countries to classify goods for purposes of customs tariffs covering approximately 98% of international trade.

⁴ International Registry of International Interests in Aircraft Equipment 10th Report Dec 2016 p6

2.16 However, the costs of a MAC registry may differ from those of the aircraft registry. Determining where costs will be similar and where they will diverge comes from understanding the number and characteristics of the products to be covered and the precise role UNIDROIT members want the registry to fulfil. Similarly, the value attached to the data by firms paying to search the database may vary, particularly given the heterogeneous nature of MAC equipment.

Costs to governments: assessment and implementation

2.17 The expertise tied up in assessing the impact of the MAC agreement, negotiating an international agreement and transposing it into domestic law will be costly, not just in direct time and legal advice but also in resource costs which may have to be diverted from other activities within government. The time taken to arrive at an agreement can be significant. A long-term commitment to negotiate, ratify and implement may involve several years' work, which can only be justified if there are significant benefits.

Compliance and access costs

2.18 These will vary depending on how the scheme is designed and operated, i.e. coverage of the scheme and the degree of monitoring/checking/policing. In the aircraft protocol, costs have been very low relative to the value of the assets documented. It focuses completely on ownership, which keeps documentation costs down.

2.19 There are numerous options as to how costs can be recovered. They could be front-loaded in a lump sum covering registration for a product's life or they could accrue annually or at change of ownership. The ideal model will be designed to maximise the chance of compliance throughout a product's life. Ideally, payment can be matched to the derivation of value from the data collected.

2.20 The characteristics of aircraft and MAC equipment assets differ in several respects: numbers, diversity of size/cost, mobility, regulation etc. Each of these may have an impact on the optimal design and operation of the registry for MAC products. A key decision will be whether a registry that only addresses ownership will support the protocol, or whether there may be ambitions to capture other information that could help to indicate likely value if an asset has to be recovered.

2.21 The markets for MAC equipment are fundamentally different to the highly regulated and very actively documented markets for aircraft in which key information on maintenance and usage is accurately logged. Determining the re-sale value of an asset is far more certain given this detailed information. There was no need for the aircraft protocol to collect this information as it was already available. For MAC equipment however, there is a question of whether it should be captured in some way, now or in the future, in collaboration with the implementation of the MAC protocol. It would clearly increase the cost of maintaining and checking data and could potentially affect attitudes towards the Registry.

2.22 However, this is also an issue several lenders have identified as valuable. It may be more appropriate to scope out voluntary options such as a completely stand-alone service for maintenance records or a link between the Registry and a store of maintenance information. It is not core to the Registry and may not be feasible at present but has the potential to complement it.

2.23 Throughout this report we emphasise the diversity of MAC equipment. Some categories already have some registration procedures via the producer. Higher unit cost items are likely to be covered by warranties and other forms of manufacturer's after sales cover, which sometimes provide some forms of tracking. In a few cases, some may even have real time internet-linked telematics. Others are largely undocumented other than numbers.

2.24 The aircraft registry⁵ set-up costs, financed by UNIDROIT members, were very low at just \$3.34m (2006) and annual operating costs of the Registry are around \$2m per year, which is lower than the fee income it generates from users. It captured around 32,000 items (not necessarily whole aircraft) in 2015. Typically, these are high value items. The cost to register an interest is very small relative to the value of the asset.

2.25 The number of individual MAC assets and or components that might be covered hasn't been assessed in any detail yet. The number of high value assets might be of a similar scale to the aircraft registry, but there are potentially hundreds of thousands or millions of lower cost assets that could in theory be within scope. Deciding where the appropriate cut-off point lies is an important decision, which will be easier to make once a narrower estimate of costs can be made.

2.26 The take-up rate for the aircraft scheme has been very high. One reason for this may be that the aircraft protocol data is particularly valuable if it "completes the set" of data and legal protection needed by lenders. The take-up rate for MAC equipment may vary, depending on the value of the information and registration costs relative to product value. In all cases the cost of registration is unlikely to be very high. The difference may lie in perceived value.

2.27 Set-up costs will be driven by the ambition of the MAC registry scheme, i.e. what kind of information it tries to capture. Average operating costs will be driven down as the take-up increases. The scheme may be able to become self-financing like the aircraft protocol. That does not make it costless. Charges on first registration are likely to be modest relative to the purchase cost larger of MAC assets, but whether this is seen as an administrative burden or an investment depends on the value attached to the data by users. Ensuring their needs for various types of MAC equipment are factored in will have a big impact on the success of the scheme.

⁵ 2015 data from www.aviareto.aero/information-centre/facts-and-figures/

Costs of transition / adjustment

2.28 Stakeholders will need to familiarise themselves with the protocol once it has been adopted by a country. For example, lenders will face learning costs in extending credit into markets where they previously didn't operate.

2.29 Where the protocol leads to additional deployment of MAC equipment, workers will take time to learn how to deploy it and maintain it effectively. Some of these are relatively visible such as training. Others, such as damaged crops, lower than expected mining yields and slower construction through ineffective use of new machinery are all examples of adjustment costs.

2.30 This section has set out the key legal changes introduced by the MAC protocol and a brief analysis of the likely costs. The cost analysis is based on experience with the Aircraft protocol registry and a preliminary qualitative assessment of the costs for the MAC protocol, including the costs of setting up the MAC registry, policy implementation and enforcement costs and the costs to business of compliance and access. Based on this initial analysis, the costs associated with the MAC protocol would appear to be low in relation to the value of the assets covered and the likely benefits. This is in line with the consensus of most commentators. Costs will be examined in more detail in phase 3 of the project.

3. Product market characteristics (MAC equipment)

Global market size

3.1 The global product market for mining, agricultural and construction equipment is currently worth around \$200 billion per year⁶ (Table 3.1).

3.2 Equipment types traded on the global market range from relatively simple, high volume items such as balers, tractors and back loaders produced in large numbers to highly specialised, low volume, high unit cost equipment such as ultra class quarry trucks which cost around \$3 million each.

3.3 At its broadest definition, the market extends beyond the manufacture and supply to include its supply chain, spares, maintenance and servicing, resale and refurbishment. There are numerous data sources quoting different figures. To develop a comprehensive picture of the global market it is therefore important to be clear about definitions. Throughout, this paper refers to new and complete equipment as specified in the MAC protocol, excluding spares.

Table 3.1: Global production and trade in MAC equipment, 2015⁷

Category	Value (\$ billion)
Estimated annual global production of MAC equipment covered by MAC protocol	200 ⁸
World imports of products covered by MAC protocol	101
UNIDROIT members' annual exports of MAC equipment	92
UNIDROIT members' annual imports of MAC equipment covered by protocol from World	80
UNIDROIT members' annual imports of MAC equipment covered by protocol from other UNIDROIT members	76

3.4 International trade in MAC equipment is significantly lower than global production. The difference between the two figures is due to domestic sales of equipment in its country of manufacture.

3.5 The introduction of the MAC protocol is envisaged to reduce the costs of the flow of MAC equipment between countries. The subset of equipment types to be covered by the protocol is defined in detail in UNIDROIT (2017).⁹ The codes covered in the protocol tend to be higher value items, typically involving equipment valued at \$20,000 or more.

⁶ 2015 Estimated global production of equipment covered by the MAC protocol

⁷ UN COMTRADE database unless otherwise specified

⁸ Industry estimates validated by extrapolation from trade data

⁹ Spreadsheet detailing Harmonised System codes proposed by the study group for inclusion in the annexes to the preliminary draft MAC protocol

3.6 If all members of UNIDROIT were to sign the MAC protocol, this would account for around 90% of global exports and 80% of global imports¹⁰ of MAC equipment covered by the protocol. The substantial gap between UNIDROIT members' exports to the world and UNIDROIT members' imports from the world is sales of MAC equipment to non-members. These are around \$14 billion per year¹¹.

Table 3.2: The importance of MAC equipment imports to selected countries, 2015

Country	MAC imports as % of GDP	MAC imports as % of total imports
Highest		
Bulgaria	1.3	2.1
Bolivia	1.2	3.9
Paraguay	0.9	2.4
Other relatively high		
Australia	0.3	1.8
Russia	0.2	1.3
Saudi Arabia	0.4	1.5
UNIDROIT member average	0.2	0.8

3.7 For some members, imports of MAC equipment form a relatively large proportion of a country's imports (see Table 3.2). The same is true for non-members. For those countries, there may be a greater benefit to be gained from ratifying the protocol if it results in a reduction in the cost of financing MAC equipment imports.

Market segmentation

3.8 The global market is diverse and can be segmented by equipment type, application, end-user and region. For example, Table 3.3 shows imports of MAC equipment, covered by the protocol, by type in 2015 by UNIDROIT members.

3.9 There are thousands of companies producing MAC equipment. Numbers are particularly large amongst those producing relatively simple agricultural and construction equipment. For example, there are over 277 brands of tractor alone¹².

3.10 Some equipment, such as trucks and diggers, can be used for multiple applications in the MAC sectors. Demand and supply conditions for seemingly homogeneous equipment can vary markedly depending on intended application and end-user sector. For example, farmers in the prairies of Canada, part-time farmers in Germany and small farmers in India all buy tractors but their needs may differ so dramatically that the specification of the machine will look very different.

¹⁰ Authors' calculation based on UN COMTRADE trade data

¹¹ Ditto

¹² Brands of tractor listed on Wikipedia

Table 3.3: MAC equipment imports by UNIDROIT members, 2015

Product Code	Equipment type	\$ billion
870190	Tractors	15.5
842952	Excavators (revolving)	12.5
842951	Front-end shovel loaders	7.7
870410	Off-highway dump trucks	4.5
847982	Mixing and crushing equipment	3.5
843351	Combine harvesters	2.8
842959	Excavators	2.5
843049	Stationary and mobile scraping and digging equipment	2.4
870510	Lorry cranes	2.3
	Other	26.3
	Total	79.8

Source: UN Comtrade data via WITS database

3.11 In some market segments there are only a handful of manufacturers. In some cases, competition is driven by productivity improvements through innovation rather than lowest purchase cost.

3.12 A relatively small number of companies have become truly global in their reach (Table 3.4). They are hugely important, particularly in the manufacture of sophisticated high cost equipment developed through investment in innovation. Each of the large companies has their own sales and marketing strategy to determine pricing, credit provision, bundled services etc.

Table 3.4: Top five global construction equipment manufacturers, by sales in 2016

Manufacturer	Construction equipment sales (\$ billion)	% of company's total sales
CAT (US)	24.1	c50%
Komatsu (Japan)	14.0	>75%
Terex (US)	6.5	>75%
Hitachi (Japan)	6.5	<10%
Liebherr (Switzerland)	6.2	>50%

Source: RBauction.com

3.13 Construction equipment is a big proportion of their business for the majority of the world's biggest construction equipment makers, with the exception of Hitachi Group where a large company is part of a vast conglomerate. Firms with a large presence in the construction equipment sector, such as CAT, are often major players in mining so overall their concentration in the MAC equipment sector is extremely high.

3.14 The same is true in agricultural equipment where market-leading firms such as Deere, AGCO, CLAAS, Kubota CNH and SDF are highly focussed on the sector.

3.15 Some of the largest producers globally are the US, China, Japan, Russia, Western Europe, Korea and India. Table 3.5 shows the leading exporters. US, Japanese and some European producers have very strong market shares in the highest technology / performance segments of the market, while Chinese exports have increased very rapidly in the MAC sector.

3.16 Producers in Russia and India have large domestic markets but are not currently major exporters, although this could change. Countries such as Japan, UK and Netherlands export a high proportion of their production.

Table 3.5: The major MAC equipment exporting countries, 2015

Country	Exports of MAC equipment (\$ billion)
Germany	15.2
USA	12.2
Japan	11.2
China	9.4
UK	5.0
Italy	4.8
Korea	3.8
Mexico	3.5
Netherlands	1.8
India	1.0

Source: UN Comtrade data via WITS database

3.17 Many low/medium cost products such as cement mixers are produced in dozens of countries worldwide. In many cases these products are primarily intended for their domestic markets.

Market conditions

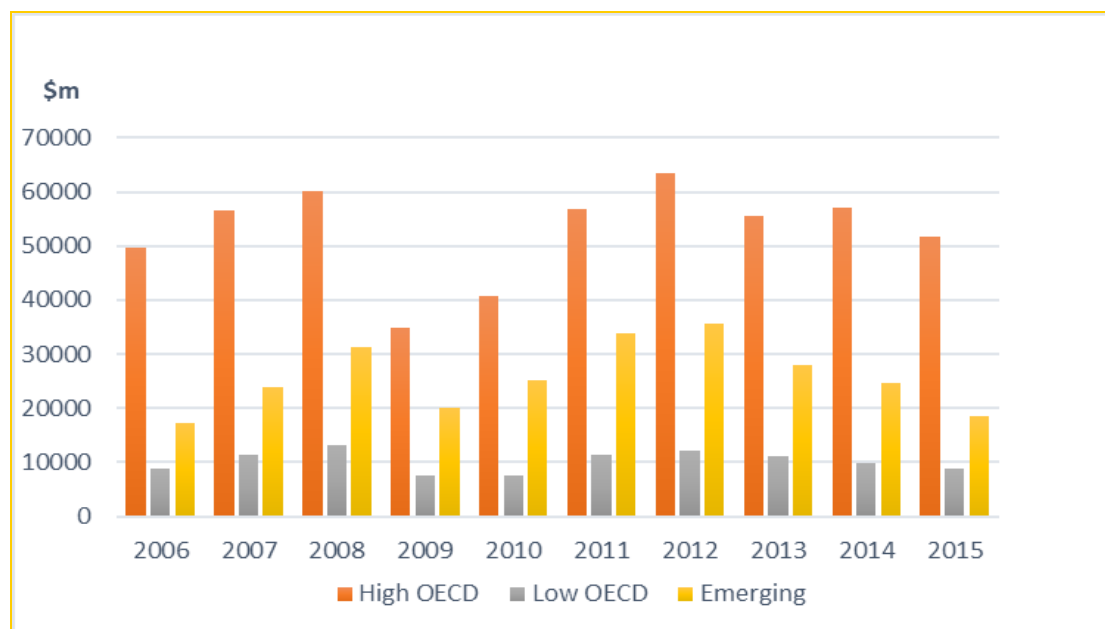
3.18 Demand, supply and prices in each equipment market segment will be determined by a range of factors.

3.19 Commodity prices have a strong impact on agricultural and mining equipment demand while construction equipment demand is typically correlated with growth in GDP and particularly with developments in the property market.

3.20 Demand for MAC equipment, particularly construction and mining can, however, be particularly volatile (Figure 3.1). The reduction in the flow of imports of MAC equipment to UNIDROIT members between 2007 and 2009, at the time of the global financial crisis, was around 45%.

3.21 Even more dramatically, the contraction in Chinese construction equipment imports from a peak of over 430,000 units in 2011 to just 131,000 units in 2015¹³ shows how quickly markets can change due to wider economic factors.

Figure 3.1: MAC equipment imports by UNIDROIT members, 2006 – 2015



Note: Categories seek to replicate CEAL groupings. High OECD are those countries with GDP/head over \$25,000, typically with highly developed credit markets. Low income OECD are those countries with GDP/head below \$25,000, with less extensive or less developed credit markets.

3.22 How supply responds to changes in demand and price signals is also unlikely to be uniform across the different equipment markets. In some segments, there may be considerable spare capacity but less so in others.

3.23 In the short run, capacity will determine responses but in the medium term many manufacturers may be able to supply a standard product, meaning that the market will respond to an increase in demand with more production and new suppliers.

3.24 The situation may be different for more specialised equipment. The huge R&D input and specialist expertise needed to develop and produce niche products makes it more difficult for new firms to enter the market, so the supply response is likely to be restricted to market incumbents.

3.25 Similarly, competition for the market will be stronger in some segments than other. Typically, where technology and innovation are critical factors, consumer choice may be driven by performance more than cost.

¹³ Off Highway Research Global Volume and Value Service cited widely

3.26 Existing studies have found very varying evidence of equipment supply elasticities for MAC equipment. For example, Edgerton (2011) argues that prices are not bid up significantly during booms, suggesting that if something increases demand, supply can respond without upward pressure on prices. However, previous research was less positive. Goolsbee (1998), for example, argues that equipment suppliers do not pass on cost savings to customers, suggesting that they might respond to an increase in demand by raising prices rather than increasing supply.

Sales routes for MAC equipment

3.27 There are multiple business models and sales routes in the MAC equipment market. The new product market may be supplied by direct sales from the company or via a local intermediary or dealer. For specialist equipment, the goods are more likely to be supplied direct while more generic products may be supplied to a dealer for on-selling. This is important as goods sold in the buyer's home country are more likely to be cash sales or financed through domestically provided credit.

3.28 The business models of some companies involve bundling together equipment with maintenance and other services including credit while others supply equipment and services separately. Along with issues of durability, maintenance costs and productivity this makes comparison between different products difficult.

3.29 While most attention is given to the new equipment market, reconditioned and used equipment sales remain hugely important. Data on used and reconditioned vehicle sales is less accurate. However, the second-hand market is likely to be very substantial including cross-border transactions. The MAC registry database can also cover used and reconditioned equipment.

3.30 Ideally, a full assessment of the impact of the MAC protocol would take account of the diversity of types of equipment, suppliers and business models, as well as the market conditions and trading arrangements affecting trade in MAC equipment. However, the data and resource requirements preclude this for the current phase of the study. Estimates will be presented on the basis of a broader assessment of global impact, but the diversity and complexity of the market need to be borne in mind in considering the results. The next section discusses the characteristics of the credit market in more detail and considers the implications of the MAC protocol for the cost and availability of finance.

4. Credit market characteristics

How MAC equipment is acquired and financed

4.1 The starting point for assessing the likely impact of the MAC protocol is an understanding of how the credit market for MAC equipment currently works. This section seeks to outline those factors that determine access to finance for MAC equipment and its cost and to specify how the MAC protocol might affect some of them.

4.2 There are substantial differences in the provision of credit depending on the country, product and borrower. A detailed assessment of the impact of the protocol on a particular country or sector would require data and analysis at a disaggregated level. At this stage of the project, we use high-level data and analysis to give an overall picture.

4.3 Many MAC equipment purchases will lie outside of the coverage of the protocol. Its primary impact is on international loans for mobile, high unit cost items. In some markets, this will form a minority of equipment purchases.

4.4 Not all purchases of MAC equipment are made using credit. In some cases, this will be a matter of choice. In many more, however, it is due to a constrained supply of credit or because individual borrowers do not meet the lenders' criteria. Table 4.1 outlines the different finance routes available and their cost to borrowers. Non-purchase options of short term hire and longer term leasing are also available. These goods are bought by leasing firms who then provide them to end users. The end user's ability to lease may be determined by some of the factors that determine their ability to buy equipment. This is not addressed separately in this paper as the goods are still covered by the same trade data and will need to be purchased before they can be leased.

Types of credit and terms

4.5 If a loan is granted on a piece of equipment, the risk to the lender depends on:

- (i) the amount of the loan;
- (ii) the degree of certainty over loan repayments; and
- (iii) the expected value of the collateral which can be recovered, net of any costs of recovery.

4.6 The MAC protocol is intended to address the third of these factors by seeking to increase the expected value of the recovered asset, firstly by making recovery more certain and quicker and secondly by allowing the creditor to realise that asset value by selling it wherever there is demand. This is explained in more detail below.

Table 4.1: Ways MAC products are acquired

Method of finance	Domestic	International	Cost to borrower
Grant-financed often as part of a wider project	National or local government, NGO etc	Aid	Nil
Concessional credit	State bank or state body with access to concessional funds	IFI, Aid donor agency	Low or very low, but scarce
Cash	Company self-finance	Multinational self-finance	Very high as capital tied up
Commercial loan, unsecured	Possibly in a small number of cases	Unlikely	Highest risk credit = highest cost credit
Commercial loan, secured on other assets	Loan secured on other assets e.g. property or land	loan secured on other assets, or receivables often outside risky country	Depends on risk
Commercial loan, secured on MAC asset	Secured on MAC asset where banking system is large enough and sophisticated.	Secured on MAC asset where international bank feels risk is acceptable, which may be improved by MAC protocol	Lowest risk to lender so cost of credit should be lower than other commercial loans

Source: Industry interviews

The buyer's perspective

4.7 From the buyer's perspective, their demand for credit will depend crucially on the financing costs of acquiring the equipment. These costs may include upfront cash payments, any interest payments over the time the equipment is needed and the capital that needs to be committed to acquire the equipment.

4.8 Cash purchases are an unattractive option for many businesses as they tie up capital that could be employed elsewhere, making it an inefficient use of resources. Few firms would choose to fund all equipment purchases by paying cash unless they had no other choice.

4.9 Unsecured loans are expensive because they are the riskiest. The creditor is exposed to the entire loan amount. As a result, they may be very reluctant to offer significant unsecured credit, other than to their best customers.

4.10 Loans secured on something other than the MAC asset are likely to be cheaper than unsecured, because the creditor faces less risk but such loans are often complex and therefore expensive to arrange and they are risky to the buyer. Deals structured on, for example, commodity income are likely to be a major step forwards for buyers as they reduce the amount of capital tied up.

4.11 Loans secured on MAC assets are likely to be the most attractive to the buyer in that they are likely to be cheaper than unsecured loans and, if property rights are clear, relatively straightforward for lenders to assess.

4.12 The MAC protocol should be beneficial to buyers as it has the potential to reduce the interest charged and to reduce the capital tied up. In many cases it may allow longer duration lending. There is a particular advantage if the loan duration can match the asset's payback period so that it can become self-financing.

The lender's perspective: how credit decisions are made

4.13 Loan decisions are made on the basis of assessing credit risk, i.e. the risk that the borrower defaults and does not meet required payments. A credit decision is based on whether the lender believes there is a sufficiently high probability of being repaid, which is in turn determined by a combination of two factors: (i) credit quality and (ii) the lender's confidence in accessing collateral to cover the exposure if the borrower defaults.

4.14 Credit quality is the combination of factors that determine the likelihood of the debt being serviced and the loan repaid. It is not affected by the MAC protocol. If credit quality is not high enough, lenders will still be reluctant to lend. However, the MAC protocol may make it possible to reduce the lender's exposure by increasing the expected asset recovery value.

4.15 If the borrower defaults, the lender stands to lose their exposure to a loan, where:

$$\text{Exposure} = \text{Loan value} \text{ less } \text{expected asset recovery}$$

Expected asset recovery depends on confidence that the asset placed as collateral can be recovered and confidence that the collateral can be re-sold to recover some of the loan value.

4.16 The quicker and cheaper an asset can be recovered, the more potential value remains and the lower the lender's exposure. The MAC protocol helps by clarifying the law to ensure that the asset can be recovered quickly and at least cost. In the absence of the protocol, the due diligence that would be required to assess the likelihood, time and cost involved in recovery is potentially huge where states have inefficient domestic laws. This can prevent deals completely, or increase the cost of credit. Contracting states that make the necessary declarations under the protocol may therefore benefit from significant reductions in risk.

4.17 It helps if there is a market for the item domestically, or freedom to export the item to a larger and more liquid market. The MAC protocol facilitates this by enabling the exportation of the recovered item to another country where it may be easier to sell.

4.18 In an unsecured loan, there is no asset attached to the loan so the expectation of asset recovery is low. A secured loan should be less costly as the risk to the lender will be significantly lower because they expect to recover a proportion of the asset value.

Factors that impact on credit availability and cost

4.19 Credit availability in the MAC sector varies very widely. In some developed country markets, particularly in North America, most machinery, new or used, is bought with a finance package. In some cases, this can be for up to 100% of the asset value¹⁴. In other countries, where credit is scarcer or harder to access, it may be as low as 20% of product value for the minority who can access credit. In high risk markets, most sales have to be predominantly self-financed. The cost and availability of credit may also depend on specific features of the product. Table 4.2 shows how product characteristics can affect credit decisions.

Table 4.2: Credit availability and product characteristics in selected sectors

Determining factors	Aircraft	Large quarry truck	Small back loader	Farm tractor
Cost	\$10-100m	\$1-5m	\$40-200k	\$20-400k
Lifespan	Long, predictable, maintenance is critical to certification	Depends on maintenance and use	Depends on maintenance and use	Depends on maintenance and use
Buyers	Relatively homogeneous firms, globally distributed	Small number, limited locations	Very varied, everywhere	Very varied, everywhere
Maintenance documented	Definitely	Highly likely	Possible	Unlikely
Duty cycle	Predictable	Predictable	Unpredictable	Unpredictable
Recovery	Low % of value	Significant % of value	High % of value	High % of value
Re-sale market	Liquid (international)	Sometimes none domestically and illiquid internationally	Liquid national	Liquid national
Expected % of value recoverable	High	unpredictable, may be low	Uncertain	Uncertain
Borrower's income	Some cyclical	Can be very volatile, driven by commodity prices and volatile demand	Depends on sector. Construction can be very volatile, sharp growth and contraction	Depends on harvests and commodity prices
Borrower's credit history	Highly likely to be documented	Likely to be documented	May be documented in some markets	May be documented in some markets

Source: Industry interviews

¹⁴ <http://equipmentfinanceservices.com/heavy-duty-truck-finance/>

4.20 More generally, the factors that determine the availability and cost of credit for the finance of MAC equipment will depend on some or all of the following factors:

Total supply of credit

4.21 In some markets, the supply of credit to the market is far lower than potential borrowers could productively invest. This may be due to general features of the economic and business environment, for example very high risks, a weak banking system, macroeconomic problems or poor quality regulation.

Size of the MAC sectors relative to the domestic banking sector

4.22 In some countries or sectors, demand for MAC equipment may be large relative to the size of the banking sector as a whole or the capital base of local banks. Potentially these scale problems can be overcome by the formation of lending consortia or attracting foreign secured lending.

4.23 Domestic credit availability is likely to be easier for less specialist and lower cost items such as tractors and diggers with multiple potential users and transparent resale markets. Highly specialised equipment is likely to be harder to finance domestically as it is typically more expensive per unit and domestic options for resale are far more limited.

4.24 A substantial advantage of secured lending from international sources is that lenders are not as likely to be as capital-constrained as domestic banks, so if they find the credit risk acceptable, they can lend large amounts. In some markets, domestic banks may also use their market dominance to charge higher interest rates than justified by the level of risk. International lenders can introduce greater competition, which is likely to keep prices under control.

Credit risk information

4.25 The quality of credit information reporting is hugely important to determining creditworthiness. Without good information on credit risk, lenders must assume very high risk and will price loans accordingly. Improving information on credit risk is therefore complementary to the MAC protocol. Both are necessary but not sufficient conditions for efficient lending in the MAC sector.

4.26 Even within the same country there is scope for huge variation between MAC purchasers. These variations will affect the ease of assessing credit quality. It will be easier to assess the credit quality of a multinational corporation with revenue streams in many locations, a strong credit history and possibly a long established relationship with an equipment supplier than a new start up. Even if both are operating in the same market sector, e.g. mining, the start-up will not have a long credit history, may only have domestic currency revenue streams and will lack the long term relationship with a MAC equipment supplier. Each of these factors may make it harder for them to access credit and more expensive if they are able to do so.

4.27 In a situation where ratification of the protocol eases the availability of secured credit within a country, lenders may initially be relatively conservative, starting by offering secured credit to the best credit risks, then expanding provision as their experience of secured lending in that market grows.

Property rights (certainty of ownership and recovery)

4.28 Property rights are fundamental to provision of secured credit. Credit is only likely to be secured on an asset where there is clarity over its ownership and there are clear rules as to who has rights over that asset in the event of non-payment or bankruptcy. Every country has laws covering these issues, but some do not appear to give lenders the confidence they need. Clarity over what the law says is one issue, however finding out how it has been applied in the past and how it might be applied in the specifics of a particular transaction is quite separate and potentially costly.

4.29 The MAC protocol should lead to greater certainty of ownership and recovery by promoting:

- (i) clarity over rights to objects via a global registry process;
- (ii) clarity over the position of creditors and where they sit in the hierarchy of claims in the event of bankruptcy;
- (iii) the right to recover the asset rapidly in the event of default, with no exceptions; and
- (iv) once recovered, the right to export the asset to recover value.

Bankruptcy law

4.30 The bankruptcy law reform set out in Alternative A of the MAC protocol should reduce risk and due diligence costs for lenders and at the margin enable secured transactions which otherwise would not proceed. Assessing this requires careful analysis on a country-by-country basis. The Aircraft protocol should provide relevant indicators, if all other differences between sectors can be allowed for. The bankruptcy law reform has the potential to make a difference in a very large range of countries¹⁵. In those countries where the law was previously unattractive to creditors, the benefits of ratifying the protocol and adopting Alternative A will be higher, as loans will previously have carried higher risk premia or not been available at all. This is an area for further analysis in subsequent phases of the study.

¹⁵ The bankruptcy provisions in the MAC protocol are optional, so countries will only enjoy these additional economic benefits where they opt in to the additional provision, which strengthens a creditor's rights in the event of bankruptcy.

Right to export

4.31 In some countries foreign lenders may face legal issues that generate uncertainty about the right to take goods out of a country. Some countries have a 'National Interest' rule to prevent critical equipment leaving the country even if a creditor needs to do so to recover an outstanding loan. The political issue behind such a rule is not trivial, particularly if there is a perception of unfair treatment. The great advantage of an international treaty is that all parties commit to the same rules. The MAC protocol will improve creditors' ability to export equipment in a timely manner. Moreover, unlike for example the rail protocol, the MAC protocol does not have a 'public service' exception that prevents creditors from enforcing their rights due to public policy.

Size of the loan

4.32 Expensive due diligence can give lenders enough certainty to make a loan even in difficult conditions. In some cases, with sufficient research it is possible to structure complex finance options where receivables in other countries provide security on loans into markets that are very high risk. Clearly this is not an option for smaller loans.

Credit Pricing

4.33 The pricing of credit within the banking sector may well be affected considerably by a range of external factors, ranging from monetary policy to competition to social policy obligations. To assess the current availability and cost of finance in particular markets would require a detailed study of transactions on a country-by-country and sector-by-sector basis.

4.34 Comparing the pricing of credit is more complex than first appears. In the UK, leading manufacturers such as John Deere currently offer rates from 2.5% APR on new equipment, which is 225 basis points over the current base rate¹⁶, with deposits from 10% of purchase price. In the same market, other types of loan, with less certainty over an object's value, are significantly more expensive, e.g. 5.95%, or 570 basis points over base rate, for a used tractor loan. The range in country can be very substantial.

4.35 In contrast, Wesbank in South Africa offers agricultural equipment loans at 12%, a spread of 525bps over the current base rate¹⁷. However, this rate appears to be dependent on installing trackers and other expenses that would need to be priced in for full comparability.

¹⁶ John Deere UK website and Bank of England for interest rates

¹⁷ Wesbank Website and SARB interest rate of 6.75% late Sept 2017

Loan duration and capital efficiency

4.36 For many firms, the loan duration and payment schedule may be at least as important as the interest rate charged. If the loan duration is shorter than the asset's payback period, then capital from elsewhere in the business will need to be reallocated to finance it. Inefficient allocation of capital is a significant impediment to business performance and to economic growth and development. The MAC protocol may give lenders more confidence that may encourage them into longer term lending.

Opportunities and limits: the impact of the protocol

4.37 The impact of the protocol will depend on the difference between the market's perception of the current situation, i.e. the effectiveness of the domestic legal regime and its application, and the market's perception of the legal regime after ratifying the protocol and implementing it. Even if the current domestic regime affords the same rights as the protocol there may be a difference in perception.

4.38 Such a perception may not be grounded in fact but may nevertheless be significant. There may also be additional due diligence costs to check domestic law, regulation and enforcement compared to checking protocol ratification and enforcement.

4.39 The CEAL analysis (Fleisig, 2013) suggested that a very large shift from unsecured to secured lending would take place, with both price and quantity benefits across a large range of countries. There is no doubt that there is a vast amount of currently unsatisfied demand for lower cost credit for MAC equipment in many parts of the world. At this stage in our analysis, however, it appears that the MAC protocol will have an impact in certain specific circumstances, but that in others, there will continue to be factors which block the expansion of credit.

4.40 In some circumstances, lenders will enjoy greater certainty/lower risk on existing loans and face reduced due diligence costs on new ones. They are likely to find that a new tranche of opportunities now pass their criteria for secured lending. It is not, however, certain that they will pass on the risk reduction in the form of lower cost credit to customers, higher lending or loans with longer duration. They may choose to take some or all of the benefit in the form of higher returns. The extent to which benefits are passed through by lenders will depend on the degree of competition in credit provision, which might be expected to increase as a result of the MAC protocol.

4.41 Users of MAC equipment will clearly benefit, assuming there is an increase in provision of credit, as they will only choose to take that credit if they want it. Lower cost and longer duration credit would also be a benefit.

Identifying factors affecting the scale of impact of the protocol

4.42 In future phases of the project, we hope to undertake detailed case studies of specific countries or sectors. In assessing the actual benefits, the following issues will need to be considered and tested:

Secured lending is likely to develop gradually

4.43 The benefits of the MAC protocol are likely to accrue gradually, particularly in markets that are undertaking wider supporting credit market reforms. Credit decisions are not purely binary. The degree of risk the lender feels they can take determines the proportion of the total asset value they will lend.

Reductions in interest rates will not be uniform across all markets

4.44 Some countries will already have easy access to domestic and international credit, thanks in part to strong bankruptcy laws, a good track record of asset recovery and freedom to export. Other countries face additional challenges in maximising the benefits from the Protocol, because a range of macroeconomic, regulatory and other risk factors will continue to deter secured lending. Many other countries are likely to see benefits.

The protocol (and associated policy changes) may enable large scale secured lending on MAC equipment for the first time in some markets.

4.45 Candidates identified by industry experts are in Southern Europe, North Africa, South Asia, Southeast Asia, Central Asia, Latin America and some countries in Sub-Saharan Africa.

The benefit of the protocol to borrowers in some markets will be a shift from credit secured on another asset to credit secured on the MAC equipment purchased.

4.46 Initially this appears to be a minor change but may offer some firms a significant increase in capital efficiency and increase their borrowing capacity. It also means that access to capital is not restricted to the most established owners of assets in a society, who are not necessarily the most entrepreneurial.

Not all borrowers in a market will be able to shift to secured lending.

4.47 In those markets where secured lending becomes available to the best credit risk customers, others will not meet the criteria for it because of: varying credit quality, limited lender confidence and varying asset recovery costs. Only part of the market will be able to benefit from a switch to secured lending.

Increased banking regulation may counteract some of the gains of the MAC protocol.

4.48 Reduced risk and lower due diligence costs incentivise banks to increase the supply of credit, but this expansion comes against the backdrop of tighter banking regulation and accounting standards. This does not diminish the importance of the protocol, but may be a force acting in the opposite direction.

It will remain easier to get secured credit on some MAC assets than others.

4.49 Those assets with a high and predictable recovery value and lower recovery costs are inherently less risky for lenders than those where value is uncertain and where recovery may be physically difficult and expensive relative to asset value, for example some assets that are underground or in remote locations or have high transport costs.

Secured lending may lead to a substantial improvement in capital allocation

4.50 The interest rate is only part of the benefit from the move to secured lending. Reallocation of capital tied up in buying MAC equipment is a big benefit too. In some countries, most MAC equipment is currently bought cash or majority cash, which ties up a great deal of capital. Where the protocol makes secured lending possible, it will dramatically reduce this capital requirement. If risk allows loan duration to match asset payback times, assets can become self-financing.

4.51 This section has argued that the cost and ease of accessing finance for MAC equipment depend on a large number of factors. In some markets, secured finance is scarce or unavailable even to low credit risk firms. The MAC protocol addresses this problem by removing some of the key uncertainties around asset recovery in the event of default or bankruptcy. However, there may well be other factors that prevent borrowers benefiting to the full extent.

5. An initial assessment of the potential global impact of the MAC protocol

A critique of the preliminary assessment by the Center for the Economic Analysis of Law

5.1 Heywood Fleisig of the Center for the Economic Analysis of Law (CEAL) provided a preliminary economic assessment of the impact of the MAC protocol in 2013. Fleisig (2013) gives an expert account of the likely benefits of reforming collateral laws drawing on the detailed treatise he co-authored on the subject in Fleisig (2006).

5.2 The 2013 CEAL study estimates the potential impact of the MAC protocol on the global equipment stock, exports and on total output or income measured by the impact on world GDP (see Table 5.1). Underpinning its estimates of impact is an assumption that the protocol is “widely adopted” and “equivalent in economic impact to the legal frameworks of secured lending in Canada, New Zealand, the United States and Romania”.

5.3 The starting point for the analysis is an estimate of \$1,978 billion for the global stock of MAC equipment in 2011 (see CEAL, Table 3). The estimate is narrowly based. It is derived from an estimate of \$424.3 billion for the value of the US stock of MAC equipment (US *Bureau of Economic Analysis*, 2011). This is compared with a US GDP of some \$15 trillion to produce a ratio of MAC equipment to total output of 2.83% which is then applied to all other countries to produce regional estimates of their holdings of MAC equipment.

5.4 The author acknowledges the use of a fixed capital/output ratio is likely to produce a substantial error for any single country but argues “it is reasonable for larger regional groupings”. However, this justification ignores the following factors:

- Capital to output ratios tend to be much higher in more advanced economies (resulting in an overestimate of the global stock).
- The proportion of total output generated by MAC sectors tends to be higher in many emerging and developing economies (as a result stock held in these economies may be underestimated).
- The rationale for legal reform is that the availability of secured credit for investments in mobile MAC equipment is constrained in economies that are less advanced than the US and other developed nations.

5.5 The use of standardised estimates of regional GDP in international dollars based on purchasing power parity (PPP) methodology stock may also overstate likely levels of the value of MAC equipment in developing countries.

5.6 A second deficiency in the CEAL analysis is that the suggested 77% increase in the post-reform stock of MAC equipment in ‘emerging and developing economies’ is no more than an assumption and lacks empirical underpinning. It appears to be derived from a single hypothetical worked example related to motor vehicles in which the ability to use a vehicle as collateral would facilitate a 77% increase in the amount of credit a lender is willing to advance and at a reduced interest rate.

Table 5.1: Estimated economic benefits of MAC protocol from the CEAL study (2013)

Category of Benefit	'Emerging and developing economies' + 'Advanced economies in need of reform'	Advanced economies	Details
Sales of MAC equipment	<p>Reflected in an increase of \$604bn in the stock of MAC equipment over 5 – 7 years, distributed as follows:</p> <ul style="list-style-type: none"> • \$541bn (+77%) increase in the equipment stock in 'emerging and developing economies'; and • \$62bn (+38%) increase in the equipment stock in 'advanced economies in need of reform'. 	Exports increase by \$60-85bn per annum over a 7-10 year period.	<p>Baseline is an estimate of the global equipment stock in 2011 of \$1,978bn.</p> <p>Global and regional stock estimates assume a MAC equipment/GDP ratio of 2.83% as observed in US economy.</p>
GDP / output	<p>Deployment of an additional \$604bn of equipment increases MAC sector output by \$1.2 trillion to \$1.8 trillion over 7 – 10 years.</p> <p>Total GDP by \$1 trillion to \$2 trillion.</p>	<p>Increased export sales boosts GDP</p> <ul style="list-style-type: none"> - annually by \$120-170bn; and - by \$1 trillion over 7 – 10 years. 	<p>MAC sector output and GDP estimates are present values. Time profile of benefits and discount rate not provided.</p> <p>Estimates for emerging and developing economies appear to be based on an assumed capital to output ratio of between 2 and 3.</p> <p>Derivation of GDP estimates for exporting countries is unclear.</p>

5.7 There are a number of sources of bias in this estimate:

- It is based on the US market and there is no discussion of whether it is realistic or representative of the credit market(s) for different types of MAC equipment in different regions.
- It contrasts a situation of no collateral with full collateral cover. In practice the difference is likely to be less extreme. For example, at least part of any increase in debt secured against MAC equipment may be at the expense of loans secured on real estate or other assets held in MAC sectors.
- No account is taken of the likely demand for credit of the borrower.
- No allowance is made for the presence of other credit risks that may limit debt availability and cap any reduction in the cost of finance. These may include country risks as well as borrower specific risks.

5.8 A projected increase of 38% in the post-reform stock of MAC equipment in 'advanced economies in need of reform' appears equally arbitrary. It is simply half the assumed percentage increase in the value of stock held in 'emerging and developing economies'.

5.9 Fleisig argues, correctly, that the benefit of additional equipment should be measured by its impact on output and estimates an increase in global GDP 2 to 3 times as great as the increase in MAC equipment. The principal mechanism is through deployment of the expanded equipment stock in low-income countries (initially defined in the paper as 'emerging and developing economies' and 'advanced economies in need of reform').

5.10 The CEAL paper suggests the additional stock in low-income countries will boost output in their MAC sectors by between \$1.2 and \$1.8 trillion in present values over a 7 to 10 year period. However, no details are provided of the expected stream of annual gains in output that could be expected as the deployed equipment stock expands over time or the discount rate used to derive the present values of the benefit streams.

5.11 The GDP estimates appear to have been derived from an assumption that average capital to output ratios generally fall between 2 and 3 based on a study by Nehru and Dhareshwar (1993) among others cited in the CEAL paper. If so, an increase in the stock of MAC equipment in low-income countries by \$604bn over a 5 to 7 year period could be expected by Fleisig to generate additional output of between \$200bn and \$300bn a year but this could only occur once the new stock has been accumulated and deployed in full.

5.12 It is difficult to 'uncover' the assumptions used in CEAL from its results. There are many different combinations of time profiles for GDP benefit streams and discount rates that would yield present values of between \$1.2 trillion and \$1.8 trillion over 7 to 10 years. For example, if we assume a simple linear build up in the additional equipment stock over 5 years and similarly in the accumulation of associated GDP benefits over 10 years, then a discount rate of around 4.8% per annum will be required to replicate these results.

5.13 While there are various supply-side channels by which increased investment in MAC equipment may increase GDP, it is unlikely that an increase anything like 2-3 times greater than the increase in the capital stock in many developing economies would occur. It is important to note that the estimates in the CEAL study are expressed as the present value of GDP gains over 7-10 years, and not as an annual flow.

5.14 The use of country or region and MAC sector specific incremental capital to output ratios (ICORs) to derive estimates of increased GDP is likely to be more appropriate than global average ratios. For example, estimates of economy-wide ICORs produced by the World Bank (2013) for selected developing countries ranged from 0.8 (Brazil) to 2.8 (China). Within their agricultural sectors ICORs ranged from just 0.3 (China) to 2.1 (Mexico), compared to between 0.8 (Turkey) and 7.3 (Indonesia) in manufacturing. However, the calculation of both incremental and average capital to output ratios presents formidable difficulties and the relationships they imply between capital investment and output can often be misleading.

5.15 Even less clear in the CEAL study is why an increase in exports of MAC equipment estimated to be between \$60bn and \$85bn each year 'should produce a rise in GDP annually of about \$120bn - \$170bn' across exporting countries. This suggests that each dollar of gross revenue received from equipment exports, as opposed to the net gain in profits and employment incomes from those exports, will generate \$2 of additional output. Unless there is significant spare capacity in the exporting economies this appears unlikely. Any expansion in exporting industries will therefore require a reallocation of resources within these economies away from other activities although less profitable ones. Some of the increased income from exports will also leak into higher spending on imports.

5.16 Fleisig may have intended the CEAL estimates to be illustrative and upper bound. He clearly acknowledges the assessment is a simple one but in so doing provides very few details of the simplifying assumptions used to derive the results. While it is sensible to reduce the complexity in economic analysis through the application of simplifying assumptions, it is also important to record what they are and why they were considered necessary¹⁸.

5.17 Against this background, the rest of this section reviews and tests the CEAL estimates and their underpinning assumptions where provided. This is intended to illustrate how the analysis may be extended to produce a more considered and evidence based assessment. Table 5.2 summarises our critique.

¹⁸ Our review and critique is based on the contents of the CEAL paper circulated by UNIDROIT to members attending the 92nd session of its Governing Council in Rome, 8 – 10 May 2013 [Ref: C.D. (92) 5(b)]. We have not been made aware by UNIDROIT of any supporting papers or annexes containing details of underpinning assumptions and calculations. While we would welcome an opportunity to discuss the paper and its analysis with its author, the project timeline has not so far allowed for this. Our findings at this stage should therefore be regarded as preliminary until we have had a chance to discuss our critique with CEAL, which we will do in the next phase of the project.

Table 5.2: Critique of CEAL study – summary

Assessment variable	CEAL study	Discussion
Protocol set-up, adjustment and learning costs	Not included	<ul style="list-style-type: none"> The resource costs of amending relevant complementary national laws and procedures may be significant at an individual country level and may slow the rate of adoption, implementation and effectiveness of the protocol.
Level and rate of adoption of the protocol	Unclear - assumption appears to be all 'low-income countries in need of reform' ratify and adopt protocol	<ul style="list-style-type: none"> It is unlikely that all member states will adopt the protocol with immediate effect. There may also be transition costs and lags in equipment registration. No counterfactual is considered in terms of how many countries would have reformed their collateral rules in absence of the protocol.
Benefits realisation	Immediate following adoption	
Baseline data	Global and regional estimates of the MAC equipment stock in 2011	<ul style="list-style-type: none"> All regional values are calculated as 2.83% of GDP equal to the 'observed' ratio in the USA. This is likely to overstate the MAC equipment stock in many emerging and developing economies. Estimates take no account of the relative size, capital efficiency or equipment needs of MAC sectors in different economies.
Credit market reaction (supply-side)	<p>Availability of credit for MAC equipment expands by 77% over the assessment period</p> <p>Average loan maturity increases from 4 to 7 years</p> <p>Interest rate spread between unsecured and secured credit post-reform is 350bps</p>	<ul style="list-style-type: none"> Values appear to be based on a single, simple example of a motor vehicle loan. Unlikely to be relevant to MAC equipment and different regional markets. Changes in supply and cost of credit unlikely to be uniform. Countries likely to benefit the most over time will be those without effective rules and procedures governing the use of and recourse to collateral, and without other significant country or region specific regulations or risks that will continue to constrain credit and limit the repossession and cross-border movement of mobile equipment. There may be some crowding out of credit for other economic sectors.
Credit market reaction (demand-side)	Implicitly assumes demand for credit is constrained only by its supply	<ul style="list-style-type: none"> Other factors (country and borrower specific) can constrain demand. There may be some substitution in demand in MAC sectors between secured and unsecured credit and credit secured against other assets. Some of the increase in demand may be for credit to be secured against pre-owned equipment rather than new purchases only.

Equipment market response	MAC equipment exports to 'developing and low income OECD countries' increase by \$60-85bn per annum over 7-10 years	<ul style="list-style-type: none"> • Appears broadly in line with the estimate of the increase in the global stock of MAC equipment but no justification is provided. • Implicitly assumes supply-side of the global equipment markets is unconstrained. Compared to baseline of \$142bn in 2010, the range represents an increase by 42 – 60% in value of annual exports even before allowing for any increase in exports to developed countries over same period. • Any short-term supply constraint could increase prices. Longer-term would require a reallocation of resources from other activities so the net increase in exports and GDP would be less. • No distinction is made between increased exports of equipment to replace obsolete equipment and new additions to the stock. Increase in stock of MAC equipment may be less than the increase in exports over the same period. • May increase the rate at which old equipment is retired and replaced. This will expand the second-hand market and may increase the demand for credit for pre-owned equipment. • No segmentation of equipment market by type, application or end-user. • No counterfactual for export sales is considered.
Assessment period	5 – 7 years (equipment stock) 7 – 10 years (exports and GDP)	<ul style="list-style-type: none"> • Assessment periods up to 10 years initially appear sensible but likely to be significant lags between adoption of the protocol and realisation of benefits. • The difference in assessment periods for stock and GDP is explained by an assertion that it will take time for countries to adjust to their new capital stocks. Again, appears broadly sensible but some gains in GDP may occur early and some additions to stock may continue well after 5 – 7 years. • Paper states that choice of 7 year adjustment period for GDP is based on a 'rough evaluation of Romania's reform'. No further details are given. Speed of adjustment may be the result of many interdependent factors.
Implied GDP multipliers	For low-income countries, based on estimated global average capital to output ratio of between 2 and 3	<ul style="list-style-type: none"> • Incremental and MAC sector specific ratios are likely to differ. • For advanced economies, the implied export (gross revenue) to GDP multiplier is 2. No justification is provided and likely to be overstated.
Discount rate	Not explicit but possibly c4.8%pa	<ul style="list-style-type: none"> • GDP benefits are presented in present values but their time profile and the discount rate used to calculate their present values are not revealed.

Sensitivity analysis

5.18 Although the CEAL study provides a useful initial model many of its assumptions are unclear and/or problematic. We therefore use the model to demonstrate the effect of modifying a number of key assumptions on its estimates of impact and, therefore, the potential range of uncertainty in those results (see Table 5.3). We emphasise that the results we derive are illustrative at this stage and should not yet be regarded as our view of the most realistic likely outcome.

Baseline equipment stock

5.18 The CEAL assumption that the MAC equipment stock in emerging and developing economies will be in the same proportion to GDP as in the US economy is likely to be a material overestimate (see para 5.7 above).

5.20 We therefore use OECD trade data¹⁹ to explore a more contemporary estimate of the global MAC equipment stock for emerging and developing economies, based on revised equipment classifications specified by UNIDROIT since the 2013 CEAL study.

5.21 To estimate a stock figure from a time series of trade data we assume an average useful equipment life of ten years. This means that, on average, one tenth of the equipment stock held in a country is replaced in each year. The stock of equipment held in a developing economy at the end of year 2015 will therefore reflect the value of its equipment imports over the previous ten years.

5.22 These assumptions will require verification and are likely to be subject to a significant margin of error. For example, the economic lives of equipment will differ markedly between different sectors, countries and regions, dependent on factors including application, usage, weather and geological conditions and the ability to maintain equipment and source replacement parts.

5.23 We derive an estimate of \$480 billion for the stock of MAC equipment in emerging and developing economies at the end of 2015. The figure is \$226 billion or 32% below that of the CEAL estimate of stock in 2011 for the same group of economies.

5.24 In the same way we derive an estimate of \$175 billion for the stock of equipment held in advanced economies in need of reform in 2015. This is just \$12 billion (7.4%) more than the CEAL estimate for the same group of economies. Included in these economies are Russia and China who are major manufacturers and increasingly important exporters of MAC equipment. The stock estimates for these economies therefore include an allowance for equipment that may have been produced and accumulated domestically although this is of less relevance to the focus of the MAC protocol.

5.25 At least part of the difference will be explained by the revised classification of MAC equipment within scope of the MAC protocol and some minor differences in the list of

¹⁹ UN Comtrade HS harmonised 6 digit imports, 2006 - 2015

countries included in the two groups of economies of primary interest. In the CEAL study they are reported to include all low-income or developing countries, all economies in transition, and the bottom third of the members of the OECD based on GDP per capita. The list of countries is not explicit in the study but section 3 in CEAL refers to the inclusion of South Korea, Spain and Italy in its group of advanced economies in need of reform despite relatively high GDP per capita.

5.26 Economic reasons why the equipment stock in 2015 may have been below that of 2011 might include the change in global economic conditions and the advance of technology since 2011, the latter having the effect of reducing the amount of equipment needed to deliver the same output. However, for the reasons given earlier, it is also likely that the CEAL study is a significant over-estimate.

Cost and availability of finance

5.26 Using our lower baselines, if we were to apply the CEAL assumptions that debt availability expands by 77% in emerging and developing economies and by 38% in advanced economies in need of reform, the MAC equipment stock in these economies would increase by \$368 billion and \$79 billion respectively, over 5 – 7 years, commensurate with the CEAL assessment period.

5.27 However, a post-reform reduction in the interest rate of 350bps for MAC equipment in the CEAL study appears high compared to spreads incorporated into assessments of the impact of the aircraft protocol. Unlike mobile MAC equipment, aircraft are more readily identifiable, have longer average service lives and must undergo regular, rigorous and certificated maintenance and inspections. Repossession risks should therefore be lower for aircraft than for post-reform MAC equipment.

5.28 Saunders & Walter (1998), for example, assume a reduction of 100bps as a result of the Aircraft protocol. It might be expected that this would be an upper limit for the interest rate reduction resulting from the MAC protocol.

5.29 We have therefore used a simple spreadsheet model to replicate and explore the relationships and figures in Table 2 of the CEAL report (reproduced in Figure 5.1), which is the basis of their assessment of credit market effects. This has allowed us to consider a range of alternative but more realistic outcomes by varying the simple assumptions that were used to derive the 77% increase in debt availability in emerging and developing economies.

Figure 5.1: CEAL, Table 2

	Cash Flow	Maximum permitted debt service payments	interest rate	maturity of loan in years	Maximum debt possible	DS/cash flow
Unsecured	\$ 500,000	\$ 175,000	8.5%	4	\$ 573,229	35%
Secured by a vehicle	\$ 500,000	\$ 175,000	5.0%	7	\$1,012,982	35%
Access to credit secured/unsecured					177%	

Source: Wright Patman Congressional Federal Credit Union; author's calculations

5.30 For example, reducing the interest rate change from 350bps to 100bps has the effect of reducing the increase in debt available to emerging and developing economies from 77% to 62%²⁰.

5.31 Assuming demand remains unconstrained and the 62% increase in credit is used exclusively to fund new purchases of MAC equipment results in an increase of \$350 billion in the stock of equipment (i.e. \$254 billion less than the CEAL estimate) over a 5 to 7 year assessment period.

5.32 Additionally, we estimate the effect of a change in loan maturity. The CEAL study assumes the length of secured loans post-reform will average 7 years compared to just 4 years for unsecured loan maturities pre-reform. Reducing the difference in maturities to two years further reduces the increase in the maximum debt available to finance new equipment to 43% or \$245 billion (i.e. \$359 billion less than the CEAL estimate)²¹.

Adoption of the protocol and benefits realisation

5.33 The CEAL study appears to assume all economies with low per capita incomes will ratify and enforce the protocol and, in so doing, realise its benefits with immediate effect. They include “all developing countries, all economies in transition, and the bottom third of the members of the OECD” (CEAL footnote 4).

5.34 However, there is good reason to believe the full impact of the protocol is likely to take far longer to achieve. It will take time for countries to adopt the protocol, implement new procedures in full and ensure compliance. It will also take time for investor confidence in their reformed systems to grow. Further, it is possible that not all countries deemed in need of reform will adopt the protocol.

²⁰ Some commentators have suggested that the impact of the MAC protocol on interest rates might be as little as 30 basis points. With a reduction in interest rates of just 30 basis points, the increase in debt availability would be only 58%.

²¹ With a 30 basis point reduction in interest rates and a two year increase in loan maturity, the increase in debt availability would be only 40%.

Table 5.3: Simple sensitivity analysis

Assessment variable	CEAL study	Revised assumption(s)	Cumulative impact on CEAL estimates (all 'low-income economies')	
			Increase in debt availability (%)	Increase in equipment stock (\$ billions)
CEAL estimates			77% / 38%	604*
Baseline equipment stock:	(2011) \$869bn*	(2015) \$687bn	77% / 38%	435 (-169)
Interest rate spread	350bps	100bps	62% / 31%	350 (-254)
Secured loan maturity	7 years	6 years	44% / 22%	245 (-359)
Adoption of protocol / benefits realisation	100%	50%	44% / 22%	125 (-479)

*All monetary values rounded to nearest \$5bn except **

5.35 For simplicity, we assume that either the rate of adoption, number of countries adopting the protocol or the speed of transition to new rules and effective enforcement procedures within adopters is half that of the CEAL study over a commensurate 5 – 7 year assessment period. Unsurprisingly this cuts the estimated increase in the equipment stock in half.

5.36 While this suggests the need for a longer period over which to estimate the stream of impacts, the longer the assessment period the greater will be the effect of discounting and uncertainty on any future GDP gains resulting from the deployment of an enhanced equipment stock.

5.37 The combined impact of the sensitivity tests in table 5.3 is to cut the projected increase in the equipment stock resulting from adoption of the protocol in low-income countries from \$604bn to \$125bn. This in turn implies additional exports of MAC equipment to low-income countries of between \$18bn and \$25bn will be required each year over a 5 to 7 year period to expand their stock by \$125bn. This would be equivalent to an annual increase of between 14% and 19% in 2015 exports and in stark contrast to the 42-60% increase in exports implied by the projections in the CEAL study.

5.38 A much reduced impact on MAC equipment exports and holdings must in turn imply a reduced impact on productivity and output in the MAC sectors of importing nations, in the equipment manufacturing sectors of advanced exporting countries and in their wider economies.

5.39 We are critical of the implied multipliers employed in the CEAL study to estimate the impact on GDP of the projected increase in the stock of MAC equipment in low-income countries and associated increase in equipment exports from advanced economies (see paras 5.11 to 5.15). Further evidence on capital to output ratios and export multipliers will be required to test and refine the CEAL assumptions.

5.40 Additionally, because estimates of GDP impact in the CEAL study are presented as 10 year present value sums they appear misleadingly high. However, to provide a simple comparison at this stage of the project we apply the same implied multipliers and discount rate from the CEAL study to our own revised estimates of the post-reform increase in the MAC equipment stock in low-income countries and corresponding rise in equipment exports. The scaled results are presented as annual equivalent GDP impacts in tables 5.4 and 5.5 below.

5.41 It is important to stress that these results and the sensitivity tests from which they are derived are still based on a very simple model and at a very high level of aggregation, which can only illustrate the potential global impact. Much more detailed study of credit markets, equipment markets and prevailing legal and economic circumstances will be required at a country and product level to arrive at more informed estimates.

Table 5.4: Estimated GDP impact in 'low-income economies'

Study	Increase in equipment stock by years 5 – 7	Average capital to output ratio	Implied annual increase in MAC sector output ²²	GDP impact (MAC sectors)
CEAL	\$604bn	2 – 3	\$200-300bn	\$1,200-1,800bn <i>(over 10 years discounted at an estimated 4.8%)</i>
Current Phase 2	\$125bn	2 – 3	\$42-63bn	\$32-48bn <i>(annual GDP impact averaged over 10 year adjustment period)²³</i>

Table 5.5: Estimated GDP impact in 'advanced economies'

Study	Annual increase in MAC equipment exports (years 1 – 10)	Implied exports to GDP multiplier	Annual increase in GDP	GDP impact
CEAL	\$60-85bn	2	\$120-170bn	\$1,000bn <i>(over 10 years discounted at an estimated 4.8%)</i>
Current Phase 2	\$18-25bn	2	\$36-50bn	\$36-50bn <i>(annual GDP impact averaged over 10 year adjustment period)²⁴</i>

5.42 The next phase of the project will include deploying our own model that seeks to get closer to the “real world” by considering issues such as credit quality, capital constraints and supply constraints. Our expectation at this stage is that it will generate results that are lower than our re-run of CEAL with revised assumptions presented here.

5.43 Nevertheless, the results suggest that even a much reduced impact on MAC equipment levels is still likely to deliver a stream of future benefits that will far exceed the costs of implementing and complying with the protocol in those economies that have yet to modernise their secured transactions laws.

²² From years 5 – 7 onwards when estimated increase in equipment stock has been accumulated and deployed in full

²³ The equivalent 10 year present values are \$250bn to \$370bn.

²⁴ The equivalent 10 year present values are \$280bn to \$390bn.

6. Developing the analytical framework

A theory of change: economic relationships and channels of impact

6.1 The development of a robust analytical framework first requires an accessible and meaningful logic model or 'theory of change', setting out how implementation of the MAC protocol (the 'policy change') will affect different economic variables.

6.2 A well-specified theory of change identifies long term economic goals, outcomes and impacts and maps out the necessary preconditions. In so doing, it sets out the key economic relationships and channels of impact as well as helping to identify evidence requirements for *a priori* assessment and *ex post* evaluation. Figure 6.1 summarises our theory of change for the economic assessment of the MAC protocol and is described in more detail below.

First-round effects (credit market)

6.3 The most immediate and direct effects of the policy change will be in the credit market for MAC equipment. In countries that undertake to reform their secured transactions laws and where equipment needs currently exceed availability due to financial constraints, the anticipated effects of the policy change are:

- an increase in the volume of credit available; and
- a reduction in the cost of secured debt relative to unsecured debt.

6.4 However, the scale and timing of these effects are likely to vary significantly across countries dependent on how quickly they are able to implement the protocol and ensure full compliance and on whether there are other regulations or country-specific risks that might limit its effectiveness.

Intermediate outputs (product or equipment markets)

6.5 The most important second-round effects of the policy change are in the product or equipment markets.

6.6 An increase in the availability of credit should enable suppliers of MAC equipment to take advantage of a latent demand for equipment from firms active in the MAC sectors of previously unreformed countries. Assuming that other aspects of the economic environment are sufficiently favourable, successful enactment of the reforms will facilitate the purchase of new equipment with secured debt. Most new purchases are likely to be from overseas suppliers.

6.7 Post-reform, therefore, there should be an increase in both the total amount of credit and the amount secured against moveable equipment in previously unreformed countries.

6.8 Suppliers of MAC equipment will respond to the increase in demand by increasing their output if it is profitable to do so. There may be price changes in addition to volume effects depending on the capacity of the global industry to increase supply at the same rate at which demand expands.

Outcomes (indirect effects)

6.9 These are the effects of the policy change on the mining, agriculture and construction sectors, and knock-on effects on their supply chains and on equipment manufacturers.

6.10 Leveraging existing equipment to fund an increase in both the stock and quality of equipment in countries that have reformed their legal and financial systems should help to boost productivity and output in their MAC sectors as well as creating new business and employment opportunities both directly and indirectly in domestic supply chains.

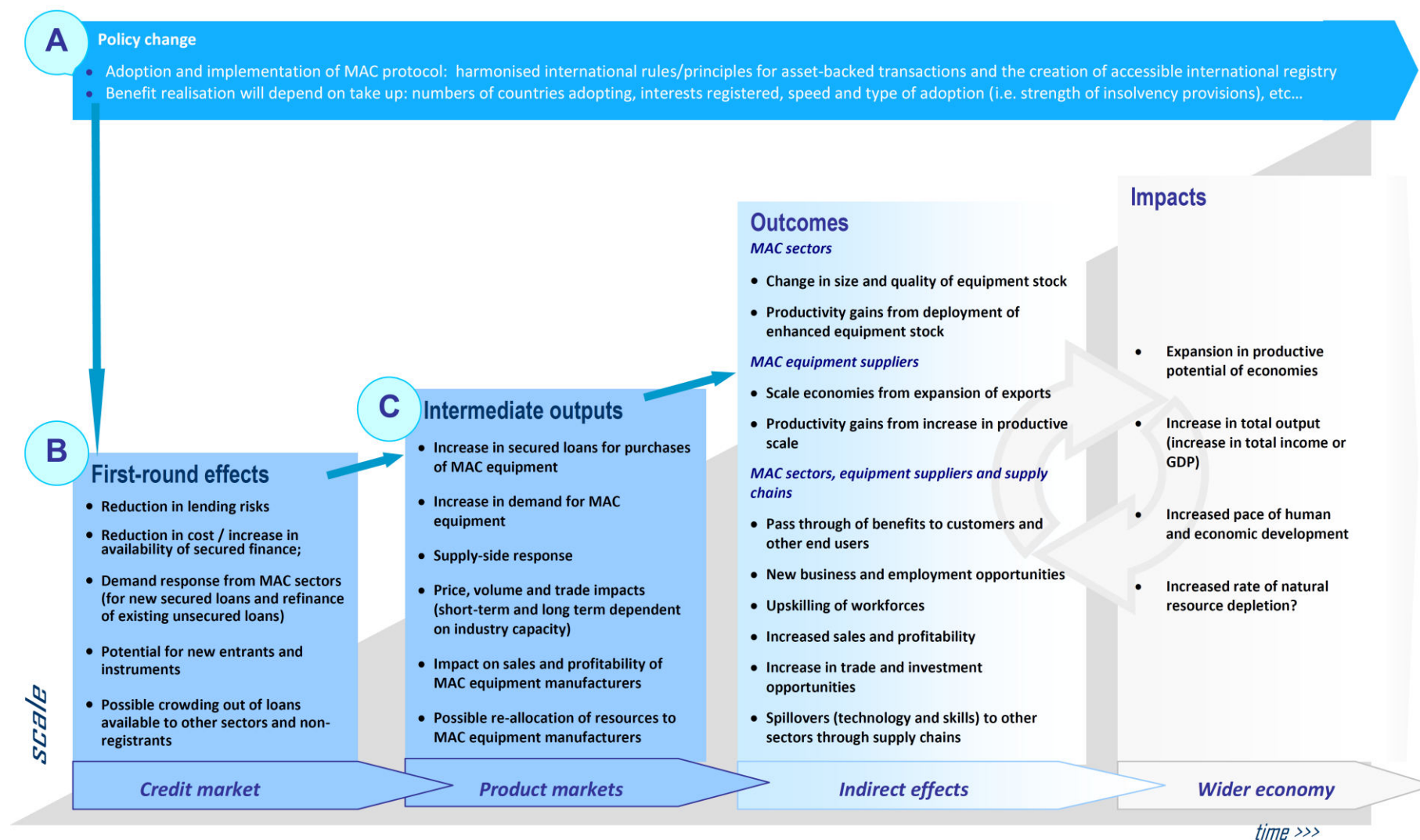
6.11 The deployment of an equipment stock that is enhanced both in terms of quantity and incorporated technology will enable greater operational flexibility, increased process and product innovation and a more efficient allocation of resources within and between firms. For example, the development and deployment of high-performance mining equipment has made it possible to extract ores of declining grades without increasing costs and has assisted transition from underground to innovative open pit mining.

6.12 Manufacturers of MAC equipment that benefit directly from an increase in demand for the machinery they supply internationally may be able to use their existing capacity more efficiently or expand their operations to leverage further technical, financial, marketing and other economies associated with increased productive scale. This in turn may allow further gains in productivity and profit margins to be secured from reconfiguring their production lines and processes. Similar gains should flow both upstream and downstream to customers and suppliers as manufacturers ramp up their production.

Impacts (wider economy)

6.13 Further positive impacts on both prices and quantities in other sectors should result from the increased activity in MAC sectors and equipment suppliers through 'multiplier' effects as increased profits and employment incomes are spent in the wider economy. Final impacts will be reflected in higher real GDP and increased prosperity. In addition, there may be impacts on the natural environment and on the resource base of the economy.

Figure 6.1: Theory of change / channels of impact



Economic assessment of impact: aims, scope and evidence requirements

6.14 The primary aim of the assessment is to identify and quantify what is likely to happen to a defined set of economic variables following the introduction of the MAC protocol (the policy change) relative to what would have happened in its absence (the 'counterfactual').

Additionally and where possible, assessment should also consider how these changes will affect different groups of net beneficiaries in different economies, specifically:

- MAC sector creditors / investors;
- MAC equipment users;
- MAC sector supply chains;
- MAC sector customers and other end users;
- MAC equipment manufacturers, exporters, investors and suppliers; and
- Governments (for example, through the displacement of state funding for MAC equipment and impacts on tax revenues and other transfers).

6.15 A simple 'framework' for assessing the net economic benefit of legal reforms of the type embodied within the MAC protocol has been presented by Jeffrey Wool of the Commercial Law Centre, Harris Manchester College, University of Oxford (Wool, 2017). It expresses the net benefit to countries adopting the protocol as:

$$\underline{\mathbf{EI}} = [(\underline{\mathbf{A}} + \underline{\mathbf{B}} + \underline{\mathbf{C}}) \times \underline{\mathbf{D}}] - \underline{\mathbf{E}}$$

where:

EI = the overall net economic impact of the new rules;

A = the net microeconomic impact of the new rules, rather than those applicable in the absence of reform;

B = the net microeconomic impact of the new rules as a network, that is, the existence of international rules;

C = the net macroeconomic, including developmental, impact of the new rules, rather than those applicable in the absence of reform;

D = the extent, measured from 0 to 1, that the new rules are effectively applied by courts and authorities (eg political/institutional risk); and

E = the net cost of creating and transitioning to the new rules.

6.16 Expressed in the terminology used in this paper, **A** and **B** are measures of the impact on GDP resulting from changes in conditions in the MAC product or equipment markets, mediated through the credit market. The term **C** includes indirect effects in related sectors and wider economic impacts. **D** is a measure of the extent to which improved rules governing secured transactions will be adopted and effectively implemented. Finally, **E** represents the transitional costs of implementing and adjusting to the new rules.

6.17 Although the precise categorisation of impacts, costs and benefits may differ, the Wool framework is fundamentally consistent with the theory of change presented in Figure 6.1. What is important is how such impacts are estimated, including the underpinning data, analysis and assumptions. Guiding principles for cost benefit analysis and economic impact assessments are well established and widely recognised²⁵. Our proposed approach will follow these principles.

6.18 The incidence, scale and timing of any costs and benefits arising from the protocol will vary from economy to economy, principally dependent on whether countries are net importers or net exporters of MAC equipment and, for the former, on their existing legal frameworks governing asset-backed transactions and the extent to which they assist or impede access to MAC equipment through their effect on the cost and availability of secured credit.

6.19 Globally, many of the costs and benefits arising from the impact of the protocol will involve transfers between different economies and between creditors and suppliers of MAC equipment and the purchasers of that equipment.

6.20 The net benefits of increased exports of MAC equipment will be the additional profits and employment incomes they generate. Similarly, the benefit of increased holdings of MAC equipment in importing countries will be the stream of additional profits and employment incomes they are able to generate through their deployment, net of the costs of their purchase and use.

6.21 The overall net economic benefit generated from implementation of the protocol will therefore be reflected in changes in factor incomes (profits, wages, rent and interest) in different economies relative to what would have happened in those incomes had the policy change not occurred. However, it is impossible to observe and measure directly such longer term impacts.

6.22 Monetisation of relevant costs and benefits will also be difficult and may in some cases be impossible. Where feasible, their assessment will also need to account for the different time periods over which they occur and for any displacement, leakage, substitution, spillover and multiplier effects. Accounting for all of these effects in any detail is well beyond the scope of existing data and analysis.

6.23 The most immediate 'first-round' effects and intermediate outputs of the policy change will form the focus of the present study, with some broad-brush assumptions about longer term outcomes and wider impacts, which we will attempt to refine in a later project phase.

6.24 Positive responses in the credit and product markets for MAC equipment underpin our assessment framework and are the necessary preconditions in the theory of change for subsequent economic gains. However, each area presents definitional, data and measurement challenges. Some we may be able to address in part using existing evidence and analyses but many will require potentially significant new primary data collection and

²⁵ See for example, HM Treasury UK (2016)

analysis. Where this is not possible, we will have to make a number of limiting or simplifying assumptions, some similar to those explicitly employed in the CEAL study, to reduce the complexity of the analysis.

6.25 Building on Figure 6.1, Figures 6.2 - 6.4 list the key issues, evidence requirements and simplifying assumptions entailed in an assessment of the policy change and subsequent responses in the credit and product markets.

- (A) **The scope of the policy change** including the rate of adoption of the protocol by national jurisdictions and the costs of transitioning to new rules.
- (B) **First round effects in the credit market** for mobile MAC equipment including how interest rate spreads and the availability of finance to different countries will be affected.
- (C) **The intermediate outputs of the policy change in MAC equipment markets.** Key considerations include the relationship between the credit market and regional equipment markets segmented by equipment type and end-user, notably how changes in the former will affect demand and supply conditions in the latter.

6.26 Successful application of the assessment framework in the next phase of work will be heavily data dependent and informed by the insights of relevant stakeholders in the credit and equipment market participants and representatives of member states.

6.27 Regional variations in impact are likely to be significant. To assess these will require a deeper environmental analysis of legal, economic, financial and trading conditions specific to different regions and member states.

6.28 Figure 6.5 sets out a number of relevant questions and issues that could be used as the basis for a 'deep-dive' analysis with relevant stakeholders including:

- how their current legal rules governing asset backed transactions and the use of collateral compare with international standards, for example, which goods and transactions do they cover and the ease and speed with which creditors have recourse to secured assets;
- equipment stocks and needs in their MAC sectors including how levels of productivity and capital/output ratios compare to more advanced economies;
- the stage of development of their banking systems, credit risks and sources of finance available for MAC equipment; and
- their international trading arrangements and how these enable or may restrict the cross-border movement of MAC equipment.

Figure 6.2 : Policy change

A

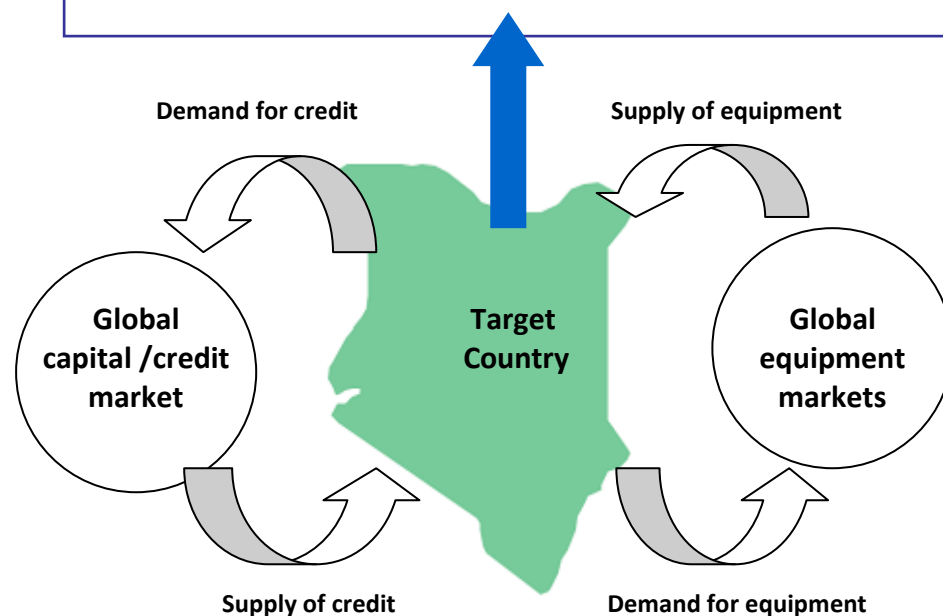
Assessment issues and evidence requirements

Final scope of protocol?

Rate of adoption of protocol by national jurisdictions, including optional insolvency provisions and equipment coding annexes?

Costs of transitioning to new rules (familiarisation/learning costs; resource costs of amending relevant complementary national laws and procedures where required)?

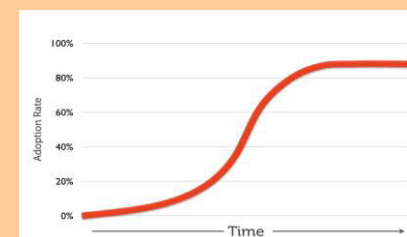
Costs/fees, accessibility and quality of registry?

**What does existing analysis assume?****Centre for Economic Assessment of Law, Fleisig (2013):**

- Full adoption of protocol and realisation of global net benefits (equipment sales estimated over 5 – 7 years; GDP impact 7 – 10 years) is immediate.
- Protocol establishes “an international framework that is economically equivalent to strongest national reforms in industrial countries” – implying all countries adopt the same fixed or optional provisions and implement them with equal competence.

Simplifying assumptions we will adopt

- 10 year assessment period;
- Rate of adoption and realisation of global benefits follow non-linear logistic functions (or S curves);



- Compliance/ enforcement increases through time but is less than 100% (range of sensitivity tbc).

Figure 6.3: Credit market reaction

B**Assessment issues and evidence requirements**

Impact / benefits likely to vary significantly by country and region. Which countries are most likely to benefit and by how much?

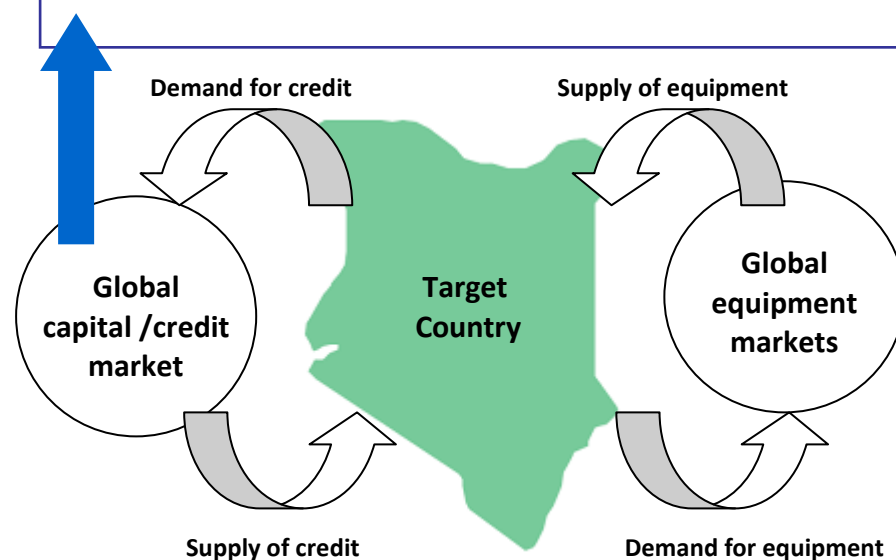
Likely reduction in repossession delays?

Impact on interest rate spreads and credit availability?

Potential for market expansion / increased competition through new entrants and new instruments?

Presence of other country specific risks and regulations that may continue to constrain credit and the repossession and re-export of MAC equipment?

Evidence of credit market reaction in countries that have reformed their collateral rules; and following aircraft protocol?

**What do existing analyses assume?****Centre for Economic Assessment of Law, 2013**

- Interest spread is 350bps (equivalent to a 43.75% rate reduction).

Aircraft equipment protocol EIA, Saunders & Walter, 1998

- In the absence of data assumes a simple average 100bps reduction

Economic Benefits of the Cape Town Treaty (aircraft), Linetsky, 2009

- Risk spread reduction depends on the credit rating of the airline and the lender's estimate of the repossession delay in the jurisdiction.
- 12 year aircraft loan with an initial 85% loan-to-value for airlines rated B would see upfront risk fee reduction of about 3.25% of the loan principal if the expected repossession delay is reduced from the worldwide mean of ten months to two months.

Simplifying assumptions we will adopt

- Spread will be 30 - 100bps.
- Any increase in secured credit expands total credit availability, i.e. expansion of secured credit exceeds any substitution in demand and supply between secured and unsecured credit.
- Unconstrained supply of capital to any one beneficiary country post-reform will be perfectly elastic, i.e. there is no crowding out of credit to other sectors.

Figure 6.4: Equipment markets response

C

Assessment issues and evidence requirements

Existing equipment stock and equipment needs by country / region?

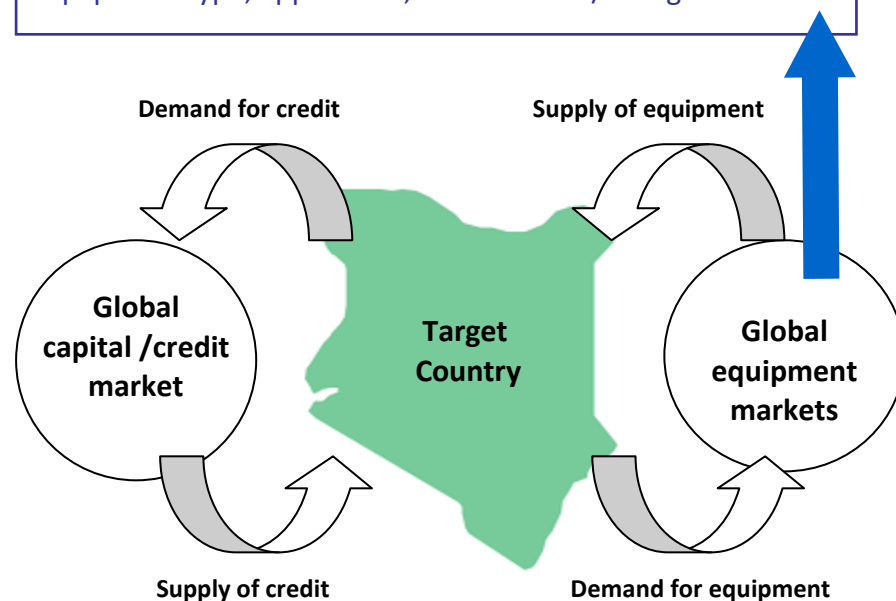
Likely demand response for MAC equipment by country/region for additions to stock and replacements?

Capacity of global industry to increase production to meet demand, short-term and longer term?

Impact on regional balances of trade (volumes and values) for MAC equipment sectors (and sub-sectors)?

Potential impact of changes on export market shares?

Ability to segment equipment market response by equipment type, application, end-user and/or region?

**What does existing analysis assume?****Centre for Economic Assessment of Law, 2013**

- Increase in demand reflected in
 - expansion of MAC equipment stock by \$604bn (+77%) over a 5 to 7 year period from a 2011 baseline;
 - increased exports of between \$60 and \$85bn per annum for 7 to 10 years equivalent to an increase of between 42% and 60% in annual exports (2010 baseline).
- Global industry has sufficient spare capacity to meet increase in demand in full.

Simplifying assumptions we will adopt

- Trade data on historic equipment imports by country combined with assumptions about average equipment lives and replacement ratios, can be used as a proxy variable to estimate baseline regional MAC equipment stock.
- Estimate potential regional equipment 'gaps' by proxy from capital/output ratios in reformed and/or most developed economies within region if available.
- Demand for MAC equipment in net beneficiary countries is constrained only by cost or rationing of secured credit.
- There are no significant short or long term capacity constraints in equipment suppliers to meet demand, i.e. real prices remain constant so there is a volume effect only because supply is perfectly elastic at prevailing prices.
- Equipment sectors and sub-sectors and export market shares are unchanged over time.

Figure 6.5: 'LEFT' field analysis - regional context, benchmarking and analysis

LEGAL	ECONOMIC	FINANCIAL	TRADE
<p>Current national legal rules for asset backed transactions and the use of collateral, including:</p> <ul style="list-style-type: none"> • What goods and transactions they cover? • Do assets require specific identification or are floating asset descriptions permitted? • Cost, accessibility and quality of asset registry? • Are there clear rules for ranking priority among different creditors or different systems for registering security interests? • Is there a unified system for establishing priority? • Ease and speed with which providers of credit have recourse to the value of underlying assets? • Ability to enforce rights against assets in the context of bankruptcy? • Number of procedures and costs required to enforce collateral? 	<p>Macroeconomic and microeconomic conditions relevant to MAC sectors including:</p> <ul style="list-style-type: none"> • Price stability, economic growth, consumer confidence, wages and labour market conditions, etc; • Degree of concentration in MAC sectors and financial health of major MAC companies; • Contribution of MAC sectors (and sub-sectors) to GDP, employment and trade; • Productivity and growth rates in MAC sectors; • Capital/output ratios in MAC Sectors; • Equipment stock and needs by MAC sub-sectors; • Rate of technological change in MAC sectors; • Presence and scale of domestic manufacturers of MAC equipment if any? 	<p>Sources of finance for MAC equipment and development of banking/financial system, including:</p> <ul style="list-style-type: none"> • Degree of competition in banking sector; • Regulation and supervision of banking sector; • Sources of funding available to MAC sector organisations to finance their capital needs; • Ratio of secured to unsecured transactions in MAC sectors; • Loan to equipment value ratios; • Spreads over mortgage rates for loans secured by real estate holdings, movable assets and unsecured loans; • Evidence of credit rationing (e.g. applications for loans rejected and reasons why)? • Financial support(s) available from government and relative importance; • Other regulations and risks that may continue to constrain credit? 	<p>System and scale of international trade in moveable MAC equipment, including:</p> <ul style="list-style-type: none"> • Value of imports / exports of MAC capital equipment by equipment type and sector? Changes over time? • MAC equipment imports / exports as a % of total imports/exports; • Major trading partners (MAC equipment)? • Trading agreements and other rules, standards or restrictions governing the cross-border movement of MAC equipment.

7. Next steps

Phase 3 work programme

7.1 Subject to confirmation of funding, the third and final phase of the current project will be delivered by the end of 2017.

7.2 The key elements additional to this preliminary report from phase 2 will be:

- (i) **Assessment of bankruptcy laws and impact of the Protocol on developed markets**
The analysis in phase 2 has focussed on testing the findings of the CEAL analysis of the impact on equipment purchases by countries in need of reform. We have not yet considered the impact of changes to bankruptcy laws and other impacts on the more advanced developed economies. This will be undertaken as part of phase 3 using available evidence.
- (ii) **Further Interviews**
Interviews will be used to strengthen the evidence base on the physical and credit market through conducting further interviews.
- (iii) **Case studies**
Case studies will be developed to assess the impact of the MAC protocol on one or more countries or product areas.
- (iv) **Developing and applying the analytical framework**
An assessment will be made of the most appropriate data to deploy to test the relationships identified in the framework. This will be a key intermediate step to building a country impact 'toolkit'.
- (v) **Refinement of estimate of global impact**
The estimates of global impact in phase 2 were based on a reworking of the CEAL study. Where feasible, refined estimates will be developed based on the analytical framework set out in Section 6.
- (vi) **Final report**
The additional material will be incorporated into a final report to UNIDROIT.

Further work

7.3 There are several areas where further analysis would help to strengthen the evidence base for the MAC protocol and other international law reforms. Some examples are:

- (i) **Detailed assessment of costs**
UNIDROIT members do not yet have a clear indication of the direct and indirect costs of implementing the protocol. The team can help with this assessment.

(ii) **Analytical tools**

Tools to help governments and companies assess the impact of the MAC protocol on their country/company. The team can develop an assessment 'toolkit' and provide countries with support to use it.

(iii) **Deeper analysis of trade data**

This will yield more details about patterns of trade than are obvious from the 6-digit data, which aggregates together products of different value and function. This information may be of more value to countries and firms than aggregate figures.

(iv) **Deeper assessment of loan data**

If data is available on loan pricing and credit risk it can be analysed to provide much more robust evidence on the impact of specific changes, to test what has been most effective.

(v) **Technical Annex**

A great deal of data analysis and literature review is undertaken for a study of this kind. Publishing a technical report covering the data and literature in more detail would provide support for the conclusions of the analysis in the final report and help encourage academics and other researchers to undertake further work in the area.

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