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**Primary and secondary legislation – assessing the impacts of
rules for making rules**

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Primary and secondary legislation – assessing the impacts of rules for making rules

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Summary / Abstract

Impact assessments (IAs) of government regulatory policy proposals set out their expected costs, benefits and risks and who is likely to face those impacts. In the UK, primary legislation can confer powers on Government ministers and other bodies to enact Statutory Instruments (SIs) and other secondary legislation. Because SIs have the same effect as Acts of Parliament, but face significantly less scrutiny, there has been a trend to increase the use of this mechanism and to use them for areas of policy or principle, rather than purely administrative procedures. However, the different timing and treatment of primary and secondary legislation has important implications for the assessment of the impacts of the proposed measures in IAs.

This paper outlines the rationale for a compound (primary and secondary) approach to introducing legislation, identifies different types of subordination and considers the implications for estimating their expected impacts in an IA - particularly when the assessment of the secondary measure happens after some of the uncertainty related to the possible outcomes of the primary measure has been resolved and this can be taken into account in the secondary decision(s). It points out the limitations of the conventional NPV-based approach to assessing the impacts of compound measures and proposes the use of a real options approach to IAs to address this concern. In particular it suggests that the real options approach should be used in cases where there are; uncertain outcomes, different possible timings, irreversible policy decisions and distortions due to the use of standard discount rates. Primary legislation creates the opportunity *but not the obligation* to pursue secondary measures and should be assessed taking these future options into account.

Keywords: Impact assessment, better regulation, secondary legislation, real options

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1. Introduction

Most versions of ‘Better Regulation’ involve various types of scrutiny (including legislative, expert and stakeholder). In systems where proposed regulation originates outside the legislature, effective discharge of the lawmaking function requires the proposer (the government, in the UK) to demonstrate an understanding of the expected impacts (the costs, benefits and risks, together with which parts of society are likely to face those impacts) of the proposal. For this reason, in the UK, Bills of a regulatory nature that affect businesses or civil society organisations should be accompanied by Impact Assessments⁵ (IAs). IAs are prepared by the sponsoring government departments and reviewed by the Regulatory Policy Committee (RPC)⁶ which provides an independent opinion on their fitness for purpose. An IA explains the problem under consideration, why the Government proposes to intervene; the regulatory policy options considered; and the rationale for the preferred option and its expected impacts. It should also describe any additional measures the Government proposes for mitigating or reallocating those impacts (for example, to reduce impacts on smaller businesses⁷ that might otherwise be disproportionately⁸ affected). The preparation and independent scrutiny of IAs, and their use in policy making, Parliamentary scrutiny and public engagement form essential and interacting parts of the Better Regulation Framework, which is intended to support⁹ policy making and improve the quality of UK regulation.

2. Primary and Secondary Legislation

In the UK, as in many other countries, some legislation¹⁰ enables further legislation and other regulatory interventions. Such primary laws are customarily distinguished from secondary legislation¹¹, which includes statutory instruments (SIs), defined in the UK as “*a form of legislation which allows the provisions of an Act of Parliament to be subsequently brought into force or altered **without Parliament having to pass a new Act***”¹². These are also referred to as *secondary, delegated or subordinate legislation*.”¹³ (emphasis added). Typically, powers to make secondary legislation are conferred on Government ministers, the Crown or public

⁵ Throughout, we refer to IAs; this should be understood as involving only *Regulatory* Impact Assessments.

⁶ The Regulatory Policy Committee is an independent expert committee sponsored by the Department for Business and Trade. It reviews departmental Impact Assessments and assesses whether the analysis of the direct costs on business and the impacts on small and micro businesses are fit for purpose. It also comments on other aspects of the IA such as the rationale and objectives, the cost-benefit analysis, the assessment of wider impacts and the monitoring and evaluation plan.

⁷ Divided in the UK into: micro (up to 10 employees), small (up to 50 employees) and medium-sized (up to 500 employees) businesses.

⁸ Proportionality reflects the balance between the opportunity cost of compliance for a class of businesses and the implications of that compliance for the policy objectives.

⁹ In the sense of leading to better policy rather than supporting choices already made.

¹⁰ In the UK, Acts of Parliament, the Scottish Parliament, Welsh Parliament or the Northern Ireland Assembly.

¹¹ Law created by ministers (or other bodies) under powers given to them by an Act of Parliament.

¹² Although secondary legislation is subject to Parliamentary processes (negative and affirmative procedures) and the prerogative powers.

¹³ House of Commons Information Office “Statutory Instruments”, Factsheet L7, Legislative Series, Revised May 2008 at: <https://www.parliament.uk/globalassets/documents/commons-information-office/I07.pdf>

bodies (for example, Ofcom was given such powers by the Communications Act 2003)¹⁴. In this paper, we refer to primary laws that enable secondary measures as ‘compound’ (as opposed to simple) regulation. SIs can be hugely consequential – for example the legal commitment to achieve Net Zero by 2050 (potentially one of the most expensive policy decisions the UK has taken in the past century) was set by statutory instrument¹⁵ after a 90-minute debate in the House of Commons and without a vote there (using a mechanism created in the Climate Change Act 2008).

It is noteworthy – and sometimes controversial – that many SIs are not subject to any detailed parliamentary procedure, and simply become law on the date stated; around 20% are introduced via an affirmative procedure¹⁶ (where the SI can be approved or rejected by Parliament, but not amended) and around 80% are laid under a negative procedure (where the SI is laid before Parliament and automatically becomes law unless either House stops (annuls) them within a fixed period – usually 40 days). Debates on SIs can last minutes or just seconds¹⁷ and the last time the House of Commons blocked a statutory instrument was in 1979¹⁸, while the Lords last did so in 2015. A House of Lords committee has commented that *“In recent years, the balance of power between Parliament and the government has shifted significantly towards the government, a trend that has been accentuated by Brexit and the pandemic ... The more that is left to secondary legislation, the greater the democratic deficit because of the absence of robust procedures enabling effective parliamentary scrutiny of secondary legislation”*¹⁹.

This can complicate and/or frustrate the pursuit of Better Regulation, especially the use of impact assessments (IAs) and the transparency that comes from independent scrutiny when the outputs (IAs on SIs and the RPC opinion on the IA) are not subject to the same level of Parliamentary scrutiny and challenge.

Because SIs have the same effect as Acts of Parliament, but face significantly less Parliamentary scrutiny, there is an incentive for government to use them as a convenient way of introducing new regulations, bypassing slow and/or cumbersome scrutiny processes. A House of Lords Committee has expressed concern that *“the underlying challenge to the balance between Parliament and government is not primarily attributable to the impact of ‘exceptional times’ ... but is instead the result of a general strategic shift by government”*²⁰.

¹⁴ How legislation works: UK Primary and Secondary legislation [https://www.legislation.gov.uk/understanding-legislation#:~:text='Secondary%20legislation'%20\(also%20called,Crown%2C%20or%20on%20public%20bodies.](https://www.legislation.gov.uk/understanding-legislation#:~:text='Secondary%20legislation'%20(also%20called,Crown%2C%20or%20on%20public%20bodies.)

¹⁵ Climate Change Act 2008 (2050 Target Amendment) Order 2019

¹⁶ <https://www.parliament.uk/about/how/laws/secondary-legislation/>

¹⁷ The debate on the Draft Contracting Out (Local Authorities Social Services Functions) (England) Order lasted 22 seconds.

¹⁸ UK Parliament: Statutory instruments procedure in the House of Commons

<https://www.parliament.uk/about/how/laws/secondary-legislation/statutory-instruments-commons/>

¹⁹ *Government by Diktat: A call to return power to Parliament*, House of Lords Secondary Legislation Scrutiny Committee: 20th Report of Session 2021–22

<https://committees.parliament.uk/publications/7941/documents/82225/default/>

²⁰ Ibid.

Conventionally, primary legislation sets an overall policy framework (for example outlining a new criminal offence) and secondary legislation guides its implementation (specifying the details of how it will be enforced), but the boundaries are not precisely defined. The Hansard Society have commented that *“the use of delegated legislation by successive governments has increasingly drifted into areas of principle and policy rather than the regulation of administrative procedures and technical areas of operational detail”*²¹.

The divergent treatment of primary and secondary legislation has implications for the role of IAs underpinning policy measures implemented through the different routes and the RPC’s scrutiny and assessment of whether they are ‘fit for purpose’. Partly these depend on what those ‘purposes’ are: ministerial decision-making; further (e.g. Parliamentary) scrutiny; or compliance with legal obligations (e.g. the SBEE Act²²), international treaties²³ and internal frameworks (e.g. the Better Regulation Framework (BRF)²⁴). The implications also extend to how independent (e.g. RPC) opinions inform subsequent primary or secondary decisions.

3. Why use a compound approach to legislation?

The advantages of structuring interventions as primary and secondary measures may include some or all of the following (as well as any strategic advantage in avoiding detailed scrutiny of the SI):

- To obtain agreement in principle before moving ahead to detailed legislation;
- To deal with different levels of detail or specificity while retaining the coherence of each legislative proposal and accompanying analysis;
- To gather or elicit information on matters that might change or clarify before implementation²⁵;
- To gather (or influence) 3rd party actions (e.g. industry stakeholders, other countries);
- To forestall or shape strategic behaviour (e.g. by using secondary legislation to cope with the different ways business may respond to primary regulation);
- To facilitate innovation (including industry self- and co-regulation);
- To adjust to other existing and subsequent regulations;
- To create subordinate powers for regulators as well as ministers to fine-tune or adjust regulations (e.g. applying regulations to specific cases, regulatory rulemaking); and
- To incorporate different expertise at different levels of rule-making.

²¹ *The Devil is in the Detail: Parliament and Delegated Legislation*, Fox and Blackwell, Hansard Society, https://assets.ctfassets.net/n4ncz0i02v4l/7LdPGXYzKwXOaV9zUyfbpT/d53a181fe4bff23c5bad1a48ff71fe99/D/evil_is_in_the_Detail.pdf

²² Small Business, Enterprise and Employment Act 2015 at: <https://www.legislation.gov.uk/ukpga/2015/26/contents/enacted>

²³ See Chapter 26 (“Good Regulatory Practice”) of the UK-Australia Free Trade Agreement at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1105083/uk-australia-free-trade-agreement-fta-chapter-26-good-regulatory-practice.pdf

²⁴ Better Regulation Framework (Guidance) at: <https://www.gov.uk/government/publications/better-regulation-framework>

²⁵ Further subordination can come from regulators’ powers (including guidance and rule-making).

Varieties of subordination

Over the last few years, the UK has seen an increase in enabling and skeletal bills that leave many important aspects of regulatory intervention to secondary legislation (rather than limiting secondary legislation to purely operational or technical matters). These more substantive forms of secondary legislation may be:

1. Enacted as needed, rather than as automatic sequels to the primary legislation;
2. Developed only after current uncertainties have been resolved by more evidence;
3. Diverse measures specific to particular sectors, technologies, policy objectives etc.;
4. Separated into 'modules' suitable for ensuring coherence with overlapping bodies of law or policy (e.g. considerations of law enforcement, public safety or environmental impact that might not apply to all aspects of the primary legislation); or
5. Skeleton legislation (known as 'Henry VIII powers'²⁶), which allow ministers to change even primary legislation without the full process that Acts of Parliament would normally require.

Taking these in turn:

The first category requires the primary IA to specify the political, market and economic conditions that should result in the implementation of the new measure (if ever). It differs from the second category by including clear enactment 'triggers', although it may not be obvious when (or even if) they are likely to occur. This requires the primary IA to make assumptions about timing to assess the impacts of enactment at a given point in time. These estimates can then be refined in secondary measure IAs when the timing is clearer.

The second category uses secondary legislation to respond to uncertainty not just by choosing when to enact secondary measures, but by adjusting many other regulatory details. The primary IA can give broad indications of the evidence that might prompt the introduction of new measures and shape potential regulatory responses, but is far less specific about the preconditions, details and expected impacts of the secondary measures.

The third category relates to situations where the appropriate regulatory intervention to a single 'problem' differs across sectors or products. This can raise difficulties in assessing the combined effects of a portfolio of secondary measures, compared to considering each measure on its own and aggregating the individual impacts. For example, the Digital Markets, Competition and Consumers Bill 2022-23²⁷ included many competition and consumer rights reforms including:

- Merger reforms;
- Market inquiries reforms;
- Providing extra powers to the Competition and Markets Authority;
- Stronger enforcement against unlawful anti-competitive conduct;
- Stronger investigative and enforcement powers across competition tools;

²⁶ These powers derive their name from The Statute of Proclamations in 1539, which conferred on Henry VIII the right to pass laws directly, thereby bypassing parliament.

²⁷ <https://bills.parliament.uk/bills/3453>

- Tackling subscription traps;
- Power to amend ‘The Consumer Protection from Unfair Trading Regulations 2008’ list of automatically-unfair practices;
- Prepayment protections;
- Stronger enforcement of consumer protection; and
- Supporting consumers and traders to resolve more disputes independently.

The RPC found this IA to be ‘not fit for purpose’²⁸ because the department had failed properly to consider the interaction between cooling-off requirements and other proposed interventions such as ‘easy exit only’, which could lead to double-counting of the impacts.

The fourth category applies, for instance, to primary legislation applying to a group of laws (which may be primary in their own right) sharing a single characteristic or overlapping in a limited way²⁹. Closely related are complex pieces of primary legislation that bring together disparate measures in a single Act³⁰ – however, the difficulties of assessing the impacts of such primary measures relate more to the breadth of their provisions and the intricacies of their interactions than to the primary/secondary distinction. The impacts of modular collections are particularly difficult to assess, since the primary measure’s subject, rationale, options and impacts may not span those of the secondary measures.

The fifth category, skeleton legislation, includes Bills like the EU (Withdrawal) Act 2018 and the Retained EU Law (Revocation and Reform) Bill which “*permits UK Ministers (and devolved Ministers in areas of devolved competence) to replace a piece of REUL [Retained EU Law] with provisions that they consider ‘to achieve the same or similar objectives’, or even to ‘make such alternative provisions’ as they consider appropriate.*”³¹ (emphasis in the original). Such measures may create delegated powers that ministers do not specifically plan to use but intend as a ‘strategic reserve’. These are particularly difficult to assess without scenario-based analyses of how they might be applied. In particular it is not generally possible to ‘fold back’ the IA of secondary measures (even if undertaken) to provide more accurate assessment of the primary IA or to take account of the deterrent or incentive effects of having such powers on the statute book. This is especially true of measures that delegate powers to reform legislation, repeal legislation deemed to be no longer of practical use, disapply or modify the

²⁸https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/115559/6/RPC-BEIS-5224_2_DMCC_Bill_-_IA_f_-_opinion.pdf

²⁹ Examples include the Retained EU Law (Revocation and Reform) Bill 2022-3, which applies to a wide range of laws based on their origin in EU legislation and the diverse measures in the Health and Care Act 2022.

³⁰ These take a wide variety of forms, ranging from the ‘omnibus’ acts common in the US and Canada – which may include a wide range of unrelated measures - to the UK’s “Miscellaneous Provisions Acts”, which include diverse collections of partially related measures. In common use until the 19th Century, they are still common in some areas. See “Tracing Acts of Parliament” House of Commons Information Office Factsheet L12 at: <https://www.parliament.uk/globalassets/documents/commons-information-office/l12.pdf> and Chapter 2 of “Political and Constitutional Reform - First Report: Ensuring standards in the quality of legislation” at: <https://publications.parliament.uk/pa/cm201314/cmselect/cmpolcon/85/8505.htm>

³¹ <https://www.hansardsociety.org.uk/publications/briefings/five-problems-with-the-retained-eu-law-revocation-and-reform-bill>

effect of a provision in any Act of Parliament³² or even to make provisions with retrospective effect if ministers ‘consider it necessary or desirable’³³.

4. Independent scrutiny in the policy development process

Independent scrutiny by the RPC can occur at three points in the policy development process (Figure 1):

- At the Options Assessment stage (pre-consultation), covering the rationale (including policy objectives), choice of policy options (including provisions for mitigating disproportionate impacts on smaller businesses) and plans for policy monitoring and evaluation, (this is mandatory, but was voluntary under the prior Better Regulation Framework³⁴);
- Before legislation is laid (introduced) in Parliament, covering the impact assessment to inform ministerial decision-making and parliamentary scrutiny of proposed legislation (this is voluntary, but was mandatory under the prior Better Regulation Framework); and
- After policy implementation, covering post-implementation review of the impacts attributable to policies, the extent to which they are achieving their objectives and whether they should be retained, revised or removed (it is a statutory requirement to include a review clause in the legislation bringing the regulation into effect, or for the Minister to publish a statement that a review is not appropriate in the circumstances).

³² E.g. Section 75 of the Banking Act (2009) at: <https://www.legislation.gov.uk/ukpga/2009/1/section/75>.

³³ House of Lords (2009) “Banking Act 2009: Supplementary report on retrospective legislation” HL Paper 97 at: <https://publications.parliament.uk/pa/ld200809/ldselect/ldconst/97/97.pdf>.

³⁴ <https://assets.publishing.service.gov.uk/media/5a7f264aed915d74e33f4a38/bis-13-1038-Better-regulation-framework-manual.pdf>.

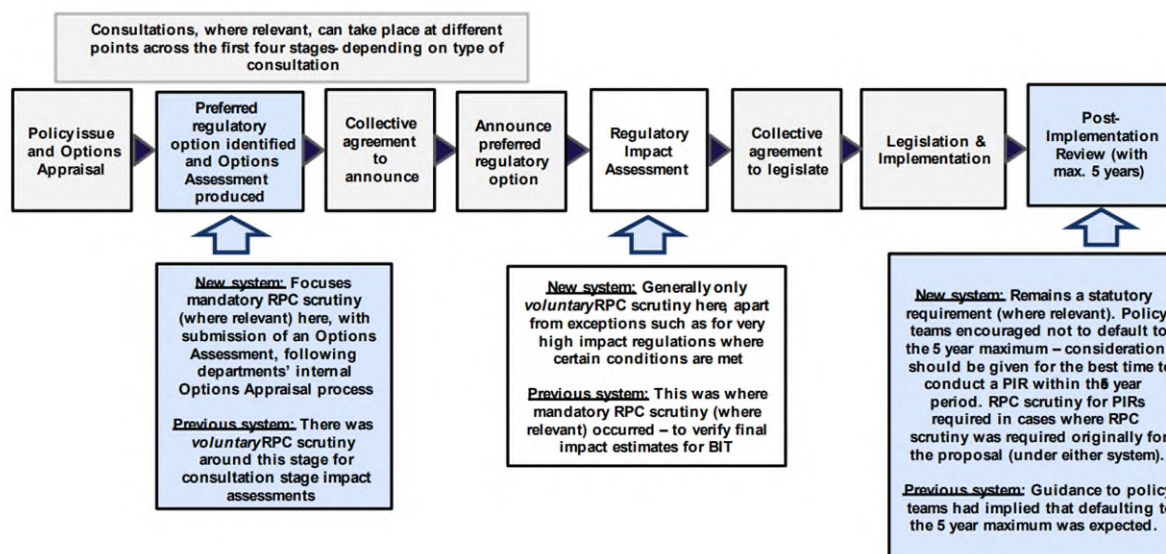


Figure 1: Independent scrutiny in the revised Better Regulation Framework³⁵

A further possible scrutiny point occurs where regulation has been significantly changed during the Parliamentary process. In this case, the department is supposed to produce an Enactment IA which shows the expected impacts of the revised measures and is then subject to RPC review³⁶.

The role of RPC scrutiny

Independent scrutiny is important to the Better Regulation Framework - it ensures that policies are based on robust evidence and analysis, aims to counter optimism bias and any default tendency towards regulation, helps to improve departments' analysis and provides confidence to external stakeholders that Government claims about the impacts of regulatory reforms are credible. It should be independent of government agendas, scrupulously neutral and proportionately rigorous. It provides a range of benefits to the quality of regulation, effective implementation and lessons learned. Moreover, it reinforces policy processes by:

- clarifying the coordination of analytic, operational and ministerial activities within and between departments and across policy domains affected by government intervention;
- ensuring that relevant evidence is properly interpreted and taken into account and that the boundaries between analysis and political judgement are clear and respected;
- supporting legislative and other forms of formal scrutiny and judgement;
- fostering public understanding through accountability and transparency; and
- helping those affected by regulation to understand its basis, purpose and intended operation – and thus how best to comply in ways that further policy objectives.

³⁵ https://assets.publishing.service.gov.uk/media/65420ee8d36c91000d935b58/Better_Regulation_Framework_guidance.pdf.

³⁶ For example the RPC review of the Environment Act Enactment IA <https://www.gov.uk/government/publications/the-environment-act-2021-rpc-opinion-green-rated>

The importance of proportionality

Assessment and evaluation should be as rigorous and detailed as necessary, but not more so. This is recognised in the Better Regulation Framework Guidance which states: “*The level of analysis should be proportionate to the problem it is addressing and reflect the scale or impact of the measure*”³⁷ and the RPC’s proportionality guidance³⁸. This raises the question of what level of evidence and analysis is proportionate for primary or secondary legislation. Almost by definition, primary assessment is higher-level and very detailed analysis may not be proportionate, useful or even possible - particularly where impacts depend on the (yet to be determined) details of the secondary legislation. More detailed analysis may be appropriate for secondary legislation, though it typically receives less (if any) Parliamentary scrutiny, may have smaller quantitative impacts and may be regarded as less important in political terms.

5. What this means for assessment and evaluation

In some cases, it is reasonable to treat the impacts of the primary and secondary legislation as a unit. This certainly applies to secondary measures that have the same rationale and are merely ‘technical’ elaborations of regulations laid down in the primary measure. It may also be the case when IAs for secondary measures include more up-to-date, accurate or specific evidence about the direct consequences of the primary measure that would be needed for an accurate assessment or full understanding of its impacts.

Holistic assessment might involve the aggregation of quantified impact indicators, but this needs to be done in a way that accurately reflects *uncertainties* about how the secondary measures will be implemented and about their impacts and possible interactions with other policy measures³⁹.

This does not mean that only secondary measures with a ‘single parent’ and a common objective are suitable for aggregated treatment – *specific* impacts of a secondary measure that can be attributed to the exercise of powers conferred by a primary measure should be included in a ‘portmanteau’ IA, even if the subsequent measure has other impacts. But this depends on the purpose(s) for which the IA was produced. If an IA is primarily intended to inform scrutiny, an aggregate account may be irrelevant until the measure is evaluated (*ex post*, when evidence of actual rather than expected impacts can be used). On the other hand, an IA that is intended to provide quantified input to an overall regulatory budget or burden reduction target⁴⁰ may require an aggregate account⁴¹. The critical considerations in preparing such aggregates are: i) the *consistency* of evidence gathered and used in different

³⁷ Better Regulation Framework Interim Guidance, March 2020

<https://assets.publishing.service.gov.uk/media/5f5b2b1ee90e0718dffc749d/better-regulation-guidance.pdf>

³⁸ Proportionality in regulatory submissions – Guidance: Regulatory Policy Committee, May 2019

<https://www.gov.uk/government/publications/proportionality-in-regulatory-submissions-guidance>

³⁹ Sometimes, a Bill will have several IAs, covering different aspects or even conducted by different Departments.

⁴⁰ For example the Business Impact Target (BIT) – see also: *The increase in the cost of regulation on business and the end of the BIT* <https://rpc.blog.gov.uk/2023/09/15/the-increase-in-the-cost-of-regulation-on-business-and-the-end-of-the-bit/>

⁴¹ A complication arises when such budgets or targets apply to a given year or Parliament, if the secondary measures come after the accounts have closed. In this case, the validated measure is necessarily incomplete, and should be qualified as such. See the RPC Guidance on assessing the impacts of time-limited measures.

contexts, from different sources and at different times; and ii) the *attribution* of secondary impacts to the primary measure – especially where a distinction is made between direct and indirect impacts.

Implications for scrutiny

For scrutinising the quality of such IAs, it is necessary to consider whether the evidence used at different points of the scrutiny process (primary IA, one or more secondary IAs) is different or inconsistent. Moreover, primary and secondary IA's may cover different sets of impacts; no IA covers all possible impacts and filters like 'direct impacts' introduce other differences – a direct impact of a primary may be indirect for one of its secondaries and *vice versa*. Furthermore, impacts quantified for a primary may differ from those for a secondary. Familiarisation and implementation costs should be treated differently; not only do they involve learning about different specific regulations, but firms that were in business when the primary took effect would have 'sunk' those costs of familiarisation, while a later entrant may need to acquaint themselves with both sets of regulations when the secondary comes into effect.

Scrutiny of an IA for the primary part of a compound intervention should consider both its fitness for purpose in giving an accurate, proportionately rigorous and useful account of the impacts of the primary and the extent to which it provides a sufficient and consistent basis for assessing the impacts of secondary measures. This will depend on whether secondary measure(s) will be assessed and their IAs submitted for independent scrutiny.

In relation to the treatment of policy objectives⁴² in the IAs, it cannot be assumed that the objectives would be completely achieved without secondary measures. To enable the assessment to cover the resulting policy risk, the need for quantification⁴³ is even stronger than for simple (non-compound) regulations. In this context, quantification allows a consistent view of the specific objectives of secondaries and clarifies the trade-offs involved in choosing whether to identify different objectives for secondaries at primary stage or to defer specific objectives, option identification and impact assessment to the secondary IA.

Quantifying objectives in the primary IA also sheds light on the value and likelihood of partial success. Finally, it permits a 'federated' objective structure that subordinates the objectives of the secondaries to those of the primary measure⁴⁴ and allows them to be linked to quantified indicators of impacts on specific stakeholders.

Another complication involves the specification of a counterfactual against which to measure impacts. One approach is for the primary IA to include a unified and detailed baseline, but it

⁴² We follow convention in differentiating: strategic or general objectives (e.g. Net Zero or promoting economic growth) that operate across multiple policy domains and measures; specific objectives tailored to a given intervention (and thus to the rationale for intervention) and implementation objectives.

⁴³ The formal requirement for objectives to be specific, measurable, achievable, relevant, and time-bound (SMART) involves a degree of quantification and links the problem(s) to the option(s) considered and the assessment of impacts.

⁴⁴ This resembles the hierarchical ordering of general (e.g. growth, Net Zero), specific and implementation objectives and the more general federation of objectives in "Smart Regulation" (Gunningham and Sinclair 2017).

may be both more proportionate and more analytically appropriate to use a high-level counterfactual for the primary and detailed versions for secondaries, especially when those measures are triggered by specific circumstances. A related issue is the description of the ‘no action’ policy option; for secondary measures, this includes the primary measure (and any powers created there).

Uncertainty will also need to be treated differently when assessing impacts of a compound measure; more information will typically be available at secondary stage and the necessary and proportionate level of detail will often be greater. This is one reason for our consideration of a real options approach (see below). The exercise of powers created by a primary measure may involve both foreseeable and unforeseen changes in what such measures are meant to accomplish. Another is that the impact assessment of secondary measures should involve at least a partial evaluation of the impacts of the primary (in line with the ‘Evaluate First’ principle) and may need to reflect that subsequent information may increase or decrease uncertainty, bring in new stakeholders, etc. Beyond its obvious analytical complexity, this will almost surely introduce inconsistencies between the analyses of a primary and the secondaries to which it gives rise. Departments should consider and anticipate this in the scenarios part of the primary IA and respond to critical changes in the secondary in line with the original objectives.

Finally, it will be necessary to develop a framework for relating these aspects (changes to objectives, adaptation to evolving information, etc.) to subsequent evaluation or post-implementation review.

6. The real options approach to Impact Assessment

Introduction

Because of the passage of time and the potential to gain more evidence as well as to refine the policy proposal between primary and secondary legislation, the evidence available to primary and secondary IAs is likely to be different. A value expected when a primary IA is prepared may be replaced by actual figures or updated expectations when the secondary IA is prepared.

One way to address some of the challenges set out above is the real options approach – primary legislation creates an option: the opportunity, but not the obligation, to pursue secondary measures. Real options provide a structured approach to decision-making under uncertainty. This approach is most valuable when uncertainty is high, early decisions may have significant irreversible impacts and when decision-makers have both significant flexibility to change the course of intervention and the willingness to learn from experience and to exercise the option⁴⁵. The standard approach to cost benefit analysis (CBA) in primary IAs assumes that policy-making is ‘passive’ with regard to developments after legislation is introduced; by contrast, a real options approach recognises ‘active’ policy-making that

⁴⁵ Locatelli, Giorgio; Boarin, Sara; Pellegrino, Francesco; Ricotti, Marco E. (2015-02-01). "[Load following with Small Modular Reactors \(SMR\): A real options analysis](#)" (PDF). *Energy*. **80**: 41–54. doi:10.1016/j.energy.2014.11.040. hdl:11311/881391

responds to developments through secondary instruments. Compound legislation combines the capability to respond with ‘forward signalling’ of the triggers for and nature of such responses. This provides a useful degree of regulatory certainty and in some conditions, effectively involves business and other stakeholders in a co-regulatory interaction by linking secondary measures to market outcomes. Since regulatory policy-making can adapt to changing circumstances and further information about beneficial, harmful and unforeseen impacts by decreasing the adverse effects of regulation and enhancing positive outcomes, the overall benefits of the compound approach can be far greater than those achievable through a standard ‘static’ approach. An example (which involved subsequent primary legislation rather than a secondary instrument but illustrates the point well) is the 5p charge for single use plastic carrier bags at large retailers introduced by the government in October 2015. This was so successful in reducing single use carrier bag usage (by over 95%), that the charge was increased to 10p per bag and extended to all retailers in May 2021⁴⁶.

A simple example⁴⁷

To illustrate how the real options approach might vary from conventional Net Present Value (NPV) analysis, consider a regulatory proposal with uncertain impacts. If enacted, there will be a positive NPV impact of £100m or a negative NPV impact of £120m, regarded as equally likely. The expected NPV is $\frac{£100m - £120m}{2} = -£10m$, so the proposal should be rejected. Now suppose instead that the intervention is compounded with a primary Bill (generating interim impacts of $\pm£10m$) followed by a secondary measure if the initial impacts are positive (with supplemental impacts of +£90m or -£110m). The Primary bill is expected to be only half as likely to produce a positive as a negative interim impact, but if the results are positive the supplemental impact of the secondary measure is expected to be twice as likely to be positive as negative. These event trees are shown in Figure 2.

⁴⁶ This example must be interpreted carefully; it illustrates the risk of assuming that more of something good must be better. This is one reason why secondary legislation may require impact assessment, including interim evaluation. This might conclude that a regulation has achieved its objectives and is no longer needed or that it has backfired. In the plastic bag charge example, a review might find that the 5p charge produced *irreversible* behavioural changes among consumers and the packaging and retail industries and could be removed. Alternatively, it might show that the charge reduces the price differential between single-use and ‘bags for life’ to the point where consumers opt for durable bags but replace them on each occasion (which would have the opposite effect to that intended). In this case, a 5p charge may be net beneficial but 10p could be ‘too much’.

⁴⁷ All variables used in this example and the extended discussion in Annex 4 are listed and defined in Annex 1.

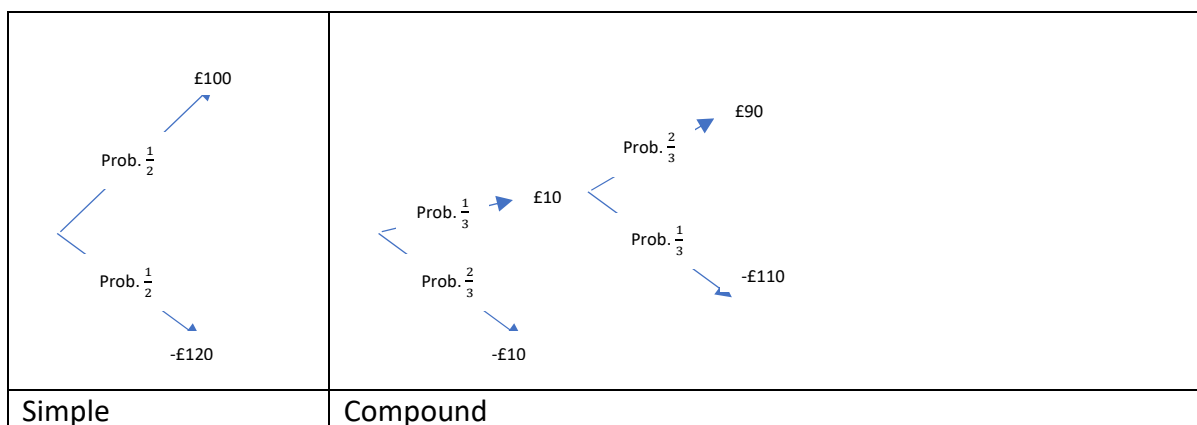


Figure 2: Event trees for simple and compound choices

Both structures offer the same potential gains and losses over the two periods (gain £100m or lose £120m) and the cumulative probabilities of each outcome are the same (50%), but the expected values are different: an expected loss of £10m for the simple approach, but an expected gain of £5.56m for the compound approach:

$$\left(\frac{2}{3}\right)(-\£10m) + \left(\frac{1}{3}\right)\left[\left(\frac{2}{3}\right)(\£90m) + \left(\frac{1}{3}\right)(-\£110m)\right] = \£5.56m$$

This improvement (which switches the policy from being net costly to net beneficial) can be attributed to the compound approach allowing the government to *learn* cheaply whether the full intervention is likely to work or not and to *adapt* the intervention to avoid wasted costs or burdens.

Similarly, when faced with a number of alternative policy options, deferring the choice to secondary legislation can provide policy makers with more information (and may unwind some of the uncertainty associated with some or all options) with which to make a better choice. Indeed, creating regulatory power while keeping multiple secondary options open may encourage other stakeholders to provide more information or to take their own action to address the problem.

Real options compared to other approaches

Traditional CBA struggles to appropriately analyse policies (or projects) that involve several stages of policy development and implementation (e.g. primary and secondary regulation and regulator application) and multiple rounds of consultation, refinement and modification prior to final implementation. The resulting uncertainty, range of 'live' policy options and the irreversibility of policy decisions require a more flexible and robust analytical model than standard NPV models, including separate NPVs of business and/or household impacts or estimated annual net direct cost to business (EANDCB). The related issues of uncertainty, discounting and irreversibility can be addressed by a real-options approach.

Regulatory decisions under uncertainty involve objective assessment of possible streams of future value and subjective evaluation of their probabilities. A third element, attitude to risk, is rarely considered explicitly (except when considering policy portfolios) but is nevertheless implied in the choice of models. This is certainly the case with NPV models.

Another potentially useful approach is to use a *decision tree*. This takes adaptive behaviour into account but can give different answers compared to real options. One reason is that decision trees use explicit probabilities and allow multiple options at each decision point, while real options models do not specify explicit probabilities and generally involve only binary choices at each stage. This makes real options less complex and less dependent on probability estimates, which may be difficult or impossible to obtain. The other difference between the decision tree and real options approaches is the treatment of discounting; decision trees generally involve the use of risk-adjusted discount rates that are the same at every point of the tree⁴⁸. In contrast, the appropriate (risk-adjusted) discount rate varies at every decision point of a real options analysis, to reflect (among other things) the impact of learning and adaptive behaviour on the risks involved.

Conversely, NPV or break-even models neither capture all impacts - especially those that are uncertain or long-term - nor give an accurate account of the spillovers linking the measure to future behaviour (including the passage of secondary regulations and regulators' actions). In other contexts (e.g. R&D policy⁴⁹ and investment appraisal⁵⁰), these shortcomings have been used to justify methods related to real options. The real options approach should be applied in cases with:

- Outcome uncertainty;
- Different possible timing of investments and policy changes;
- Irreversibility of decisions (including businesses' sunk investments); and
- Distortion due to the use of simplistic standard discount rates, which
 - blend time discount and risk-adjustment factors, creating the false impression that impact risk follows a time path with no predictable pattern; and
 - do not account for the further information produced by primary (and other early) regulatory implementation, which decreases uncertainty (and risk) over time.

Real options can help to address formally not only measurable returns, but also the intricacies of market and technological uncertainty, timing, irreversibility, and the discount factor associated with strategic, long-term policy decisions. Real regulatory actions commonly involve multiple aspects whose individual impacts interact and should be valued together⁵¹. This feature makes them unsuitable for conventional discounted cash flow methods, which approach the analysis from a decentralised perspective and treat each regulatory choice separately.

The advantages of real options in assessing compound legislation

The real options methodology draws heavily upon the fundamentals of risk neutrality. This offers three advantages. First, it allows the various options available in compound regulations

⁴⁸ Indeed, this is regarded as an advantage in that it guarantees time-consistent decisions.

⁴⁹ Vonortas and Desai 2007.

⁵⁰ *Real Options and Investment Valuation*, Chance and Paterson, The Association for Investment Management and Research, 2002 <https://www.cfainstitute.org/-/media/documents/book/real-publication/2002/real-v2002-n1-3917-pdf.ashx>

⁵¹ Trigeorgis, 1996.

to be incorporated in the analysis. These include choosing the time and circumstances to: take further action; stop or restart intervention; abandon or disapply provisions; or expand regulatory scope. Second, the approach can use all the quantitative information contained in international comparators, market data and other external evidence. Third, it allows the use of powerful analytical tools developed in contingent claims analysis to evaluate relevant impacts and determine optimal implementation trajectories⁵² (exercise of real options).

These characteristics are especially promising for assessing delegated powers created by primary measures. Such powers may be used in unintended ways, kept in reserve as hedges or even deterrents against future challenges or used to modify existing powers. The attention paid by real options analysis to the decisions that would be made under different circumstances and the impact on the likelihood of alternative futures forces a consistent and explicit view of relevant scenarios. In addition, real options analysis concentrates attention on developments that might change discrete policy decisions which reduces analytic dependence on evidence that may be imprecise, difficult to aggregate or even unquantifiable; what matters are the triggers for change.

The use of such methods can, in turn, make regulatory policy-making more strategic by enhancing the contribution of impact assessment to policy process, rather than using it simply as an exercise in ‘checking the numbers’ after decisions have been made.

In summary, primary legislation that creates powers to be exercised through secondary measures constitutes a real option, which enables but does not compel future action. Its value lies in how those future choices will be made and implemented – its impacts include theirs. The primary law also influences the probabilities of different future decisions; this changes the way businesses and other stakeholders view the future and the consequences of the choices they must make. Finally, this changes the risks associated with these decisions and the appropriate adjustment to discount rates.

The relation between financial and policy applications of Real Options

Although the roots of real options analysis lie in financial economics, its relevance to policy assessment has been extensively noted in the literature⁵³. Building on that framework and subsequent applications to public R&D investment policies, significant aspects of the assessment of compound regulations can be linked to financial analogues:

- The direct costs of primary legislation are analogous to a financial call option;
- The direct costs of secondary measures are analogous to the exercise price of a financial call option;
- The stream of quantifiable impacts of a secondary measure is analogous to the value of the asset underlying a financial call option;

⁵² Schwartz and Trigeorgis, 2001.

⁵³ For example the US Office of Management and Budget’s Circular A-4, which provides guidance to Federal Agencies on the development of legally-required regulatory analysis. See US Office of Management and Budget (2003) esp. the section on “Treatment of Uncertainty”.

- The downside risk of a primary measure is that the powers it creates will not be used and initial implementation costs and responsive business investments will be lost – for a financial call option, this potential loss would be the price of the option;
- Increased volatility or uncertainty would decrease the value of any eventual regulatory intervention - and thereby increase the value of an option (a compound structure);
- Longer assessment horizons would decrease the present value of pre-committed interventions, but increase the value of options on those interventions; and
- A deregulation option is analogous to a financial put option.

The question of how to go about exploiting future opportunities reverts to a question of how optimally to exercise the corresponding call options. Academics and financial practitioners have studied this problem in (financial) stock option pricing theory where the value of a stock option is formally expressed as a function of underlying parameters. The basic principles arising from this work can be transferred to the arena of ‘real’, that is, nonfinancial, options (timing, growth, abandonment, flexibility).

The general implication is that real options approach can usefully be applied to many aspects of the Impact Assessment process, whenever justified by uncertainties and complex timing issues. However, our focus here is narrower: interpreting secondary legislation and regulatory rulemaking as real options when assessing primary legislation. The conceptual question is how best to structure options (design the powers in primary legislation); the practical questions are how to assess uncertainties and risk attitudes and how to apply the formula in the absence of sufficient ‘hard’ data.

On the data question, we point out that market data as used in financial contexts have two important characteristics; they are necessarily quantified, and those quantities can be assumed to reflect consensus (equilibrium) judgements. Under the ‘Law of One Price’, a portfolio that produces the same pattern of returns (across time and possible states) as an intervention must have the same value. Once this is determined, it is an easy matter to find out what options on that portfolio are worth and, by implication, what deferred or delegated interventions are worth. But market data are not essential for this – in the absence of priced assets that exactly replicate the consequences of a decision, it is possible to treat that decision itself as a synthetic asset (the so-called marketed Asset Disclaimer) and bring the process of analysing options on it from there.

In practical Impact Assessment contexts, this means identifying different end states in terms of exogenous factors (like economic behaviour), determining the conditions under which the powers would be exercised in one way or another and the likelihood of those conditions and ‘working back’ to the beginning. In the current context; this has only two stages – the end state is the exercise of powers (secondary measures) and the beginning state (the different options for primary legislation).

An example application

The above discussion suggests that Real Options can be used to reduce the assumptions necessary consistently to assess compound interventions. The following simple example illustrates how this might work.

There is a legislative proposal that will impose costs of £125m. If implemented today, it will yield benefits next period of £200m or £80m; on current information, these are equally likely. The riskless discount rate is 5%. To evaluate this requires knowing the appropriate risk adjustment. Suppose there is an asset, currently priced at $P_a = £120$ per share, whose value changes proportionately to the benefits of the proposal; it is equally likely to cost $\frac{5}{3}P_a = £200$ or $\frac{2}{3}P_a = £80$ next period. Obviously, 1m shares of this asset replicates the gross benefits of the proposal, whose current value is thus $£120 * 1m = £120m$. The NPV is $£120m - £125m = -£5m$ and the proposal should be rejected (unless preferred on policy grounds). We compute the appropriate risk-adjusted discount rate (r) by observing that the gross impacts of the measure (£120m) are the expected future impacts discounted back to the present:

$$£120m = \frac{.5*£200m + .5*£80m}{1+r} \text{ so } r = \frac{.5*£200m + .5*£80m - £120m}{£120m} = 16.7\%.$$

Now suppose we create the power (option) to implement the measure by secondary legislation depending on further information that resolves current uncertainty. If this suggests the good state (a positive signal; expected future gross impact of £200m), the secondary legislation will be enacted for a net future impact of $V^+ = £200m - £125m = £75m$. If not (a negative signal), the power will not be used for a net impact of $V^- = £0$ (i.e. avoiding the cost of £125m). The original asset won't replicate this pattern of returns (£75m or £0), but a portfolio consisting of A shares of the asset and B in riskless bonds will if:

$$V^+ = A \left(\frac{5}{3} P_a \right) + B(1 + 5\%) = £75m$$

$$V^- = A \left(\frac{2}{3} P_a \right) + B(1 + 5\%) = £0m$$

from which the 'replicating portfolio' consists of 625,000 asset shares and $-£47.62m$ bonds. The present value of the proposal with the power to make secondary legislation is thus:

$$V^0 = A * P_a + B = 625000 * £120 - £47.62m = £27.38m$$

Without the power to make secondary legislation, the proposal (option) would be worthless, while with the power it has a positive value. Annex 4 sets out an example that extends this approach into a further period and shows the impact on the risk-adjusted discount rate and the risk-neutral probability of the proposal.

Discounting

A closely connected problem is the difficulty of discounting impacts at different points in time. The analytic time horizon, counterfactual, baseline and *status quo ante* may all have changed significantly between primary and secondary decision points. This has an additional technical aspect; a forward-looking assessment should take account of how today's intervention will affect future decisions as illustrated by the example above. Indeed, almost all regulatory impacts result solely from changes in behaviour – by businesses as well as by ministers using

delegated powers and regulators applying regulations. The standard UK Treasury⁵⁴ approach is to use a constant reference discount rate; the analytic justification for this being that it guarantees time consistency - that decisions anticipated today will in fact be chosen in the future. If interest rates and other economic conditions change substantially between the primary and secondary IAs, the assumptions made for one will not apply to the other; this applies especially to situations where secondary measures can disapply or modify existing rules. This poses problems for developing IAs. It also complicates RPC scrutiny, which examines the appropriateness of assumptions about behaviour and discounting and the proportionality of analysis given the stakes and available information.

7. Conclusions and recommendations

The paper notes the growth in the use of compound legislation comprising primary and secondary parts in recent years. It concludes that the choice between simple and compound regulatory structures – and their impact assessment and scrutiny - should be based on a Real Options Perspective: primary legislation creates the opportunity – but not the obligation – to pursue secondary measures and should be assessed taking the exercise of those future options into account. This is especially important when:

- the regulatory problem involves substantial uncertainty that may resolve over time;
- intervention can elicit further information;
- there is considerable flexibility over when and how the intervention takes effect;
- the impacts of the various parts of a compound measure are irreversible; and
- the use of a single standard discount rate is misleading in relation to learning and attitudes to risk.

This approach is rarely adopted in practice, where it is much more common to specify in advance future regulatory or compliance behaviour and thus the (desired) results of current measures.

In addition to the advantages of real options as indicated above, the design of compound interventions with a combination of pre-specified and outcome-based contingencies can help to: resolve regulatory uncertainty; guarantee consistent expectations among stakeholders whose compliance with regulations determines whether the objectives will be achieved and the nature of the associated costs and benefits; and involve those stakeholders and government authorities in a dynamic game of co-regulation. In this respect, the public nature of impact assessments and the use of compound measures follow the path of Smart Regulation and draw on the theoretical framework of Mechanism Design as well⁵⁵.

⁵⁴ HM Treasury Green Book, <https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government/the-green-book-2020>

⁵⁵ See e.g. Cave (2013) and Howlett (2014).

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Annexes

Annex 1. Variables

Variable	Definition
V^0	Present (period 0) value of the intervention's impact
V^+	Future (period 1) value of impact following a positive signal
V^-	Future (period 1) value of impact following negative signal
V^{++}	Future (period 2) value of impact following 2 positive signals
V^{+-}	Future (period 2) value of impact following 1 positive and 1 negative signal (in either order)
V^{--}	Future (period 2) value of impact following 2 negative signals
A	Shares of equivalent asset in a replicating portfolio
B	Riskless bond holding in a replicating portfolio
P_a	Present (period 0) price of equivalent asset, per share
P_A^+	Future (period 1) price of equivalent asset following a positive signal, per share
P_A^-	Future (period 1) price of equivalent asset following a negative signal, per share
π	The 'objective' probability of a positive signal
p_{RN}	The 'risk-neutral' probability of a positive signal
r	A risk-adjusted discount rate
ρ	The rate of return on riskless debt (i.e. gilt rate)

Annex 2. Recognition in the current UK Better Regulation framework

The UK Better Regulation Framework Guidelines⁵⁶ recognise the complexities outlined in this paper to a degree:

“Primary and secondary legislation can be part of a single policy development process. Therefore, where a measure is implemented through a combination of primary and secondary legislation, the IA will evolve and develop as the requirements of both sets of legislation are finalised and the underlying information and modelling is refined. In cases where the final policy position of future secondary legislation is unclear, the IA for primary stage legislation should describe examples of the potential scale or nature of impacts, if the powers are used. Where impacts cannot be monetised at that stage, Departments should provide at least a narrative based IA that describes the impacts.”

“Where the IA for the primary legislation covers all the expected impacts of the secondary legislation, the existing IA can be re-used to support the clearance of the secondary legislation. If the policy changes significantly during the process, or further information – that was unavailable at the time of the primary legislation – substantially alters the impact of the measure, then the IA for the secondary legislation should be revised proportionally to ensure it reflects:

⁵⁶ Better Regulation Framework Interim Guidance, March 2020, <https://assets.publishing.service.gov.uk/media/5f5b2b1ee90e0718dffc749d/better-regulation-guidance.pdf>

a) changes to the scope of the secondary legislation;

b) greater clarity on the impact of the secondary legislation, if this had been uncertain when the IA for the primary legislation was prepared;

c) new information that has become available, which changes the assumptions underlying the IA for the primary legislation.

This revision should be proportionate to the scale of the measure and the difference that the revision makes to the estimated impact of the measure.”

Annex 3. The UK and other countries

Similar considerations apply to other regulatory activities and are applied in different ways in the Better Regulation frameworks of other jurisdictions. IAs in the United States of America and Canada are required for draft regulations generated by agencies with delegated regulatory power. They therefore do not cover primary legislation, but only secondary legislation such as regulations produced by agencies like the Environmental Protection Agency in the USA or Health Canada. In addition, they are confined to regulatory policies, not taxation and public expenditure. In the UK, the rulemaking power of regulators is much more restricted, so the obligation and purposes of IAs and their scrutiny have an inherently ‘secondary’ flavour. In the UK the obligation to assess impacts is broader, but *independent scrutiny* of those assessments is limited⁵⁷ to regulatory actions that have an impact on business of more than $\pm£10m$ pa ($\pm£5m$ pa under the previous Better Regulation Framework).

When other countries adopted IAs, it was often extended beyond legislation. Today most countries (but not the USA) see impact assessment primarily as an instrument to design primary legislation. The UK is something of an outlier in laying down conditions for IAs of both primary and secondary legislation.

Annex 4. Extended example

The relation between risk and discounting: two equivalent approaches

The example in the main body applies a real options approach to assessing the impacts of provision for secondary legislation. We can choose different data and analytical approaches.

The ‘replicating portfolio’ approach builds up the value of a compound regulation using known impacts of the simple alternative. The optimal exercise of secondary legislation power represents a change to the simple policy’s pattern of impacts. This new pattern is replicated by a portfolio consisting of the simple policy (the asset) and a riskless bond. The price of this portfolio is the impact of the compound option.

To compute the expected impacts, we can choose between two equivalent approaches; this illustrates how risks and discounting are conflated in standard NPV analyses. After describing

⁵⁷ Better Regulation Framework Guidance, Department for Business and Trade, Sept 2023 https://assets.publishing.service.gov.uk/media/65420ee8d36c91000d935b58/Better_Regulation_Framework_guidance.pdf ; note that scrutiny of final-stage IAs is only required for measures that had serious deficiencies in the Options Assessment and have direct impacts on business exceeding $\pm£100m$.

the approaches in abstract terms, we illustrate them by extending the above example to include a second period of potential learning and deferred action.

Consider a risky regulatory initiative that has expected impacts V^0 as of period 0. This will increase to V^+ (with probability π) or fall to V^- (with probability $1 - \pi$) in period 1. The riskless discount rate is ρ .

The risk-adjusted discount rate r makes V^0 equal to the present value of the initiative:

$$V^0 = \frac{\pi V^+ + (1 - \pi)V^-}{1 + r} \quad \text{i.e.} \quad r = \frac{\pi V^+ + (1 - \pi)V^- - V^0}{V^0}$$

NPV computation of V^0 works if we know the correct risk-adjusted discount rate. However, there may be no such data or the patterns of returns of a compound regulation may be difficult to match to those of assets with known values.

If r is unknown, we could alternatively compute the risk neutral probability (p_{rn}) of a positive signal, which would give the same present value when next period's expected impact is discounted back to the present using the riskless discount rate (which is generally known, because all riskless assets are equivalent). This gives:

$$V^0 = \frac{p_{rn}V^+ + (1 - p_{rn})V^-}{1 + \rho} \quad \text{i.e.} \quad p_{rn} = \frac{(1 + \rho)V^0 - V^-}{V^+ - V^-}$$

These approaches are illustrated for the one-period example in the following Table.

	Simple primary regulation	One-period compound regulation
V^0	-£5 net (£120 gross)	£27.38 net
V^+	£200 gross	£75
V^-	£80 gross	£0
r	16.67%	36.96%
p_{rn}	38.33%	38.33%

Two-period compound regulation

Now suppose that the power to make secondary legislation in the main example is extended by another period, potentially allowing the government to obtain even more precise information or equivalently allowing the impact of a secondary measure to increase or decrease again. In the original example, action in period 0 would lead to gross impacts of £200 or £80 in period 1, interpreted as the period 1 present values of an indefinite stream of impacts into the future. Extending the decision horizon expands the government's options.

Simple regulation

In the simple case, the government had a single go/no-go decision; pass primary legislation or take no action. If the decision hinged only on the NPV, the government would take no action, leading to a net impact of £0.

One-period compound regulation

In period 0 the government chooses between taking no action, passing simple legislation or passing primary legislation enabling secondary measures. In the latter case, in period 1 the government chooses between passing secondary legislation or taking no action. This latter choice could depend on whether the new information was positive or negative. In the event,

the optimal choice was to pass primary legislation in period 0 and pass secondary legislation in period 1 if and only if the information was positive. The net impact is £27.38.

Two-period compound regulation

In period 0 the government chooses between taking no action, passing simple legislation or passing primary legislation enabling secondary measures. In the latter case, in period 1 the government chooses between secondary legislation or waiting for more information. In the second (and final) period, it decides whether to act or to abandon the intervention.

The impacts for the 2-period case are derived as follows.

Using the ‘replicating portfolio’ approach, consider the evolution of the equivalent security above; a share representing the simple regulation’s impacts costs £120 in period 0. This grows by $\frac{2}{3}$ to £200 or falls by $\frac{1}{3}$ to £80 in period 1. If this pattern is repeated in period 2, the price will grow by $\frac{2}{3}$ or fall by $\frac{1}{3}$. After two periods the potential outcomes would be:

- $£120 \left(\frac{5}{3}\right)^2 = £333.33$ after two positive signals (probability $\frac{1}{4}$)
- $£120 \left(\frac{5}{3}\right) \left(\frac{2}{3}\right) = £133.33$ after one positive and one negative signal (in either order) (probability $\frac{1}{2}$)
- $£120 \left(\frac{2}{3}\right)^2 = £53.33$ after 2 negative signals (probability $\frac{1}{4}$)

Giving an expected value of £163.33

Now suppose that one positive signal has been observed: the government can pass secondary legislation now (for an expected NPV of impact of £75 as shown in the one-period example) or defer the decision to the last period. If the final signal is positive, the gross impact will be £333.33; if the implementation cost stays at £125, the net impact will be £208.33. This exceeds the impact (£0) of abandoning secondary legislation. If, on the other hand, the final signal is negative, secondary legislation in the final period would have a gross impact of £133.33 and a net impact of $£133.33 - £125 = £8.33$, which again exceeds impact of abandoning secondary legislation. So, deferring the decision following an initial positive signal means that the government anticipates passing secondary legislation in period 2 regardless of the signal.

To find the value of this deferral, we can create a replicating portfolio as we did for the one-period example. However, the payoffs (risks) are different, so the portfolio will be different. A portfolio of A asset shares and B in riskless bonds replicates the returns if:

$$V^{++} = A \left(\frac{5}{3} P_A^+\right) + B(1 + 5\%) = £208.33$$

$$V^{+-} = A \left(\frac{2}{3} P_A^+\right) + B(1 + 5\%) = £8.33$$

Instead of using the period 0 asset price ($P_A = £120$), we use the price of a share in period 1 after a positive signal: ($P_A^+ = £200$). This portfolio comprises $A = 1$ share of the asset and $B = -£119.05$ in bonds. In period 1, it costs $1 * £200 - £119.05 = £80.95$.

If the initial signal was negative, the government would not defer to period 2, it would abandon the intervention for an optimised expected NPV of £0 (as shown in the one-period example). If it does defer the decision to the final period and the next signal is positive, the

gross impact will be £133.33 and the net impact will be £8.33 as shown above. If the second signal is negative, secondary legislation in the final period would have a gross impact of £53.33 and a net impact of £53.33 – £125 = –£71.67; the government would optimally abandon the intervention. So, deferring the decision following an initial negative signal means that the government anticipates passing secondary legislation in period 2 only if the next information is positive. We can find the value of this deferral by creating a replicating portfolio; A shares of the asset and B riskless bonds replicates the returns if:

$$V^{-+} = A \left(\frac{5}{3} P_A^- \right) + B(1 + 5\%) = £8.33$$

$$V^{--} = A \left(\frac{2}{3} P_A^- \right) + B(1 + 5\%) = £0$$

In this case, instead of using the period 0 asset price, we use the period 1 price following a negative signal: $P_A^- = £80$. The “replicating portfolio” now comprises $A = 0.104$ shares of the asset and $B = -£5.29$ in bonds. This costs $0.104 * £80 - £5.29 = £3.04$, which is the impact of deferring in period 1 after a negative initial signal.

These are the values we should expect to see in secondary measure impact assessments following initial positive or negative signals. To assess the primary measure, we complete the analysis by considering the option from the period 0 point of view. If the government decides not to create the power to pass secondary measures, it will not pass a simple measure (with impact -£5 as shown above) but abandon the initiative for an impact of £0. If it passes a primary measure, it expects an impact of £80.95 if the next signal is positive (anticipating a further delay to the final period as shown above) or £3.04 if the next signal is negative (expecting to defer again in period 1 and adopt secondary legislation in period 2 only if the second signal is positive). The impact of a period 0 decision to pass a primary measure is the cost of a portfolio that replicates these returns:

$$V^+ = A \left(\frac{5}{3} P_A \right) + B(1 + 5\%) = £80.95$$

$$V^- = A \left(\frac{2}{3} P_A \right) + B(1 + 5\%) = £3.04$$

This portfolio has $A = 0.649$ shares of the asset and $B = -£41.95$ in bonds. In period 0, it will cost $0.649 * £120 - £41.95 = £35.96$, which is thus the impact of the compound legislation option. This is the appropriate impact figure to use in the primary measure IA.

One final remark concerns the discount rates that accompany this analysis. The above computation uses riskless bonds and the risky asset in various proportions to replicate the risks of the legislative measure at different stages. But as noted above, the same values can be obtained as NPVs using either i) the objective probabilities and suitably risk-adjusted discount rates or ii) risk-neutral probabilities and the riskless discount rate. We can illustrate these using the formulæ given above (as in Table 1).

	Period 0	Period 1	
		after positive signal	after negative signal
Current impact	$V^0 = £35.96$	$V^+ = £80.95$	$V^- = £3.04$
Future impact after positive signal	$V^+ = £80.95$	$V^{++} = £208.33$	$V^{+-} = £8.33$
Future impact after negative signal	$V^- = £3.04$	$V^{-+} = £8.33$	$V^{--} = £0$
Risk-adjusted discount rate: r	16.79%	33.82%	36.96%

Risk-neutral probability: p_{rn}	44.56%	38.33%	38.33%
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Discussion

This example shows that use of objective probabilities combined with a standardised constant discount rate will not properly account for the changes in risk over time and across various secondary legislation scenarios. This has nothing to do with assumptions about risk aversion (the example assumes risk neutrality throughout). The computations show that taking account of the possibilities for learning and adaptive behaviour can reverse policy decisions and materially affect the estimated impacts of policy proposals.

Specifically, if decisions are made based only on expected net impact in the example:

- A simple go/no-go decision will result in no intervention, for **an impact of £0**;
- Adding one-period compound option will result in primary legislation in the period 0 followed by secondary legislation in period 1 if and only if further information is positive, for **an impact of £27.83**;
- Allowing a longer horizon for deciding about secondary legislation will result in primary legislation in period 0, deferred decision in period 1 (regardless of the information received) and secondary legislation in period 2 (unless both observations are negative), for **an impact of £35.96**.

The real options framework is highly flexible; the example can be modified to include sunk costs (familiarisation, implementation, precautionary investments), recoverable costs, partial implementation, deregulation or regulatory experiments or sandboxes as well as simple delay.

The multiple equivalent ways to compute these real option values (replicating portfolios and computations based either on risk-adjusted discount rates or risk-neutral probabilities can be selected to make best use of available data e.g. to obtain robust estimates by minimising dependence on weak data. In particular, market-based data used to construct and price replicating portfolios can be supplemented by analytic data on patterns of regulatory impacts using the simple version of the regulation as the original asset. In this way, existing regulations can be used to provide information as a benchmark for the assessment of new proposals.

The risk-neutral probability approach lends itself to automated valuation of highly complex options and requires only the risk-free discount rate (which is typically readily available), as opposed to the risk-adjusted rate, which changes throughout the decision sequence and is computationally-intensive and sensitive to the assumptions used.