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REVIEW OF OFGEM'S RIIO2 BETA ESTIMATION

De-gearing and re-gearing of betas

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1 INTRODUCTION

National Grid (NG) and Scottish Southern Electricity (SSE) have jointly commissioned Frontier Economics to review an aspect of Ofgem's proposed methodology in estimating the cost of equity for RIIO2, in relation to the de-gearing of the estimated benchmark equity betas.

Ofgem has proposed two nonstandard adjustments on the de-gearing procedure:

- **MAR adjustment** – adjusting the observed enterprise-value gearing level by the Market to Asset Ratio, effectively converting the enterprise value to RAV in the denominator;
- **Market Value Factor adjustment** – adjusting the resulting gearing level further by applying a Market Value Factor – a ratio between the fair market and the book value of the net debt.

Both adjustments have the direct effect of decreasing the estimate of the cost of equity, compared to the traditional method without these adjustments.

We carried out a review of the reasonableness of these two adjustments. We find that these two adjustments lead to an implied level of gearing in Ofgem's estimation of the cost of equity that is economically meaningless. Moreover, we also consider that the former of these two methods is inconsistent with finance theory, practice and the recommendations of Ofgem's own advisor Indepen. As a result Ofgem's estimate of the cost of equity is too low.

Separately, this paper also discusses the merit of the first of these two adjustments as a potential regulatory instrument to remedy the phenomenon of a high MAR. We find that as a regulatory instrument, the MAR adjustment on the gearing level used to de-gear equity betas is misplaced, as it will likely lead to poorly justified regulatory decisions and has the potential to weaken materially incentives to invest and to improve efficiency of the regulated networks.

2 OFGEM'S METHOD IS TECHNICALLY INCORRECT

It is common in corporate finance, when estimating the cost of equity, for the observed equity betas from benchmark companies to be de-geared to unlevered asset betas, and then re-geared to the gearing level of the entity in question, in order to control for the different levels of leverage of the benchmark companies that may be used to determine a beta for the target company.

The underlying principle of this de-gearing exercise stems from the Modigliani-Miller theorem that, with increasing gearing, as more weight is put on the relatively cheaper debt capital, the remaining equity capital becomes more costly reflecting the increased financial risk of the business. The overall effect of these two factors is such that the weighted cost of capital of a company does not depend on the level of gearing, in the absence of default risk and any tax shield on debt cost.[1]

Therefore, a de-geared (or unlevered) asset beta derived from comparator companies can provide a like-for-like benchmark for the (unlevered) target company. After assessments are made on the appropriate asset beta, based on the sample of comparator benchmark companies, the target company gearing can be applied to the asset beta in order to derive the appropriate like-for-like equity beta for the target company.

In order to perform this de-gearing and re-gearing exercise, Ofgem must determine the gearing level of the benchmark companies relied on to estimate betas for the price control in question, in order to calculate unlevered betas from its estimate of levered betas. It has hitherto derived the gearing level of benchmarks from the EV of the company and the book value of debt, an approach considered standard. Ofgem has then hitherto re-geared the asset or unlevered beta to the level of notional gearing it identifies as appropriate.

Ofgem now proposes to deviate from standard finance practice by carrying out two adjustments to the gearing level used to de-gear the benchmark equity betas:

- **MAR adjustment** – adjusting the observed enterprise-value gearing level of benchmark companies by the Market to Asset Ratio, effectively converting the enterprise value to RAV in the denominator of calculation to derive unlevered betas;
- **Market Value Factor adjustment** – adjusting the resulting gearing level of benchmark companies further by applying a Market Value Factor – a ratio between the fair market and the book value of the net debt.

The first adjustment effectively converts the basis on which the equity capital in the gearing level of benchmark companies is measured from market valuation to a book value equivalent (RAV)[2]. In other words, with this adjustment, Ofgem is de-gearing market-value-based benchmark equity betas using book-value gearing levels.

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1 See, for example, Modigliani, F.; Miller, M. (1958). "The Cost of Capital, Corporation Finance and the Theory of Investment". American Economic Review. 48 (3): 261–297.

2 We recognise that RAV is indexed to inflation, so it is not entirely book value in the accounting sense, but it does not contain up-to-date market valuation. Therefore overall it is more book value than market value.

We can immediately assert that this is contrary to accepted finance theory (as found for example in finance text books) and best practice. We are not aware of any theoretical foundation, regulatory precedent or practitioners' examples that support this method. It is in fact a commonly cited mistake in finance literature, highlighted as one for practitioners to take care to avoid. In the present environment of the MAR being larger than 1, this directly results in an under-estimation of the cost of capital.

We note that Ofgem has not provided any evidence to support why this unusual (in our view incorrect) step in its method is justified, apart from referring tangentially to a study from its advisor Indepen. However, as we describe below, Indepen in fact recommended a different method to address a related issue, not the MAR adjustment that Ofgem has adopted[3]. We explore this in more detail below.

The second adjustment is to convert the book value of debt (used to derive the gearing level of benchmarks) into a market value of debt. There appears in our view to be some confusion in Ofgem's method as to whether book value or market value should be used to measure the gearing level. Ofgem is converting equity capital from market value to book value, but at the same time converting debt capital from book value to market value. Therefore, the second adjustment is not even internally consistent with the (flawed) approach that Ofgem itself seems minded to adopt, i.e. to convert values to book values.

The aggregate result of these two adjustments is that the gearing level that Ofgem is using to de-gear the raw equity betas of the benchmark companies is derived from the **market value of debt** and the **book value equity**, leading to a gearing level that is inconsistent with standard finance theory and practice, over-estimated and meaningless.

Should Ofgem persist with a method that embodies these errors, Ofgem would under-estimate the cost of equity for its ongoing RIIO-2 price controls.

We explore below in more detail the errors contained in Ofgem's two adjustments.

2.1 MAR adjustment on gearing is unjustified

2.1.1 Finance theory and practice

In order to de-gear an equity beta to arrive at an asset beta, the consensus in finance theory and practice is that the level of gearing applied to de-gear the benchmark equity betas of benchmark companies needs to be measured on a consistent basis with the approach adopted to estimate the benchmark equity betas. For example, this requires that the gearing level used to calculate unlevered betas should reflect the same time period over which the benchmark equity betas are estimated. Text book finance best practice also requires the gearing level to be measured in a market-reflective manner, and in particular that the equity capital be measured at market capitalisation value – the same basis on which the equity return is measured in the benchmark equity beta estimation.[4]

[3] Indepen, Ofgem Beta Study – RIIO-2 Main Report Final, December 2014.

[4] See, for example, Pratt and Grabowski, Cost of capital, Fifth Edition, 2018

To make this flaw in Ofgem's method more concrete, it is certainly true that the stock returns for the firm (which are used to estimate the raw beta) reflect all of the assets and all of the debt. There is no basis for using stock returns that reflect all of the assets in one step of the approach, and then de-gearing using a gearing estimate that reflects only a portion of those assets. This creates a clear inconsistency.

If the book value of the equity is used to de-gear, then this is consistent with an assumption that the level of debt has precisely the same effect on 'gearing up' equity returns regardless of how high or low the equity is valued in the market. This illogical assumption would have a very troubling implication that is inconsistent not only with corporate finance theory, but also with common sense. The effect that the debt has on residual equity returns must, of course, depend on whether there is a small or large amount of equity. To put this another way, the effect of adding some quantum of debt to an existing business will certainly vary depending on how much equity there is in the business to accommodate that debt.

The book value approach implicitly assumes that it is only the notional book value equity that supports debt – that all of the debt finance is supported by the RAV and that no other cash flow stream supports any debt.

The rationale for using market value estimates of gearing is clearly explained in leading textbooks. For example, Koller et al (2005), an applied practitioner textbook, begins by noting that the very derivation of the WACC formula begins with market value definitions of the value of debt and equity. It follows that book values, including regulatory book values such as the RAV, have no place in the estimation of the WACC:

> *"Using market values rather than book values to weight expected returns follows directly from the formula's algebraic derivation (see Appendix B for a derivation of free cash flow and WACC). But consider a more intuitive explanation: the WACC represents the expected return on a different investment with identical risk. Rather than invest in the company, management could return capital to investors, who could reinvest elsewhere. To return capital without changing the capital structure, management can repay debt and repurchase shares, but must do so at their market value. Conversely, book value represents a sunk cost, so it is no longer relevant."*

A version of the classic Brealey and Myers textbook is even more explicit about the need to adopt market value gearing:

> *"[After presenting a book value balance sheet for an example company called Geothermal]…Why did we show the book value balance sheet? Only so you could draw a big X through it. Do so now. We hope this will help you remember that book values are not relevant to estimating the cost of capital. When estimating the weighted average cost of capital, you are not interested in past investments but in current values and expectations for the future. Geothermal's true debt ratio is not 50 per cent, the book ratio, but 40 per cent [the market value ratio]."*

One of the most reputed finance academic and practitioner, professor Aswath Damodaran at NYU, uses the market value of equity in his Debt/Equity ratio calculation in his asset beta database[5], which is well referenced source for sector-

[5] http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/Betas.html

wide readily available asset beta estimations for academics and practitioners around the world. On the contrary, we are not aware of any reputable institutions that uses the book value as the basis to measure equity capital in the beta de-gearing process.

2.1.2 Indepen's recommendation

It would appear that Ofgem's adjustment has been inspired by advice it has received from its advisor, Indepen. However based on our review of Indepen's report, it seems equally clear to us that Indepen has not in fact recommended to Ofgem the MAR adjustment that Ofgem presently proposes to adopt.

Indepen has instead criticised the way regulators **re-gear** the unlevered beta using a notional gearing measured in RAV terms, and suggested that there is an inconsistency in this approach. It states on page 32 of its report:

> *The fact that we are using observed equity βs and de-gearing them using the actual gearing (based on enterprise Value gearing) while potentially re-gearing them based on a RAB gearing notional value creates an inconsistency. Consistency requires that an Enterprise Value notional gearing level be established.*

Indepen recommends to adjust the notional gearing level used in the re-gearing process by **dividing by** the EV to RAV ratio (i.e. MAR), such that the notional gearing used to re-gear is also based on EV. However, if Indepen's recommendation is to be adopted, Ofgem would then also have to use a weighting for equity of [1 - EV gearing] in the WACC calculation. In this way, EV would be used consistently through all steps.

We note that Indepen's study does not explicitly address the question as to how its proposed re-geared beta should be used in the calculation of the WACC. However, we consider that the approach we set out above is the only appropriate approach in order to ensure a consistent calculation of the resulting cost of equity calculation. The net result of this in terms of the overall WACC would be broadly in line with the traditional method used by the regulators than the method currently proposed by Ofgem.[6]

Ofgem's proposed method, on the other hand, converts the gearing from EV to RAV by **multiplying by** the MAR. The resulting cost of equity is, however, then taken into the WACC calculation with a weighting equal to [1 - RAV gearing]. Given that Ofgem is currently assuming a MAR of 1.1, RAV is assumed to be smaller than EV, hence RAV gearing would be higher than EV gearing for the same value of net debt. As a result, Ofgem's method would underestimate the WACC.

In conclusion, Ofgem's proposed book value de-gearing adjustment, which involves multiplying the EV gearing with the MAR, is inconsistent with finance theory, best practice and Ofgem's own advisor's recommendations.

[6] The exact extent to which this statement holds true will depend on how the overall WACC reacts to the gearing level.

2.2 Market Value Factor adjustment on debt is inconsistent with the rest of the methodology

Ofgem's adjustment on net debt value in the gearing level appears to be inconsistent with what Ofgem sets out to do elsewhere in its calculation of the cost of capital. If Ofgem's methodology is to convert the gearing level to book value basis, than multiplying the EV gearing with the market value factor of debt does not make sense as it does the opposite.

More specifically, the formula that Ofgem proposes to use to derive the adjusted gearing level is EV gearing * MAR * market value factor. Mathematically, this formula does not lead to a meaningful gearing level.

To help understand exactly what is being measured, and subsequently adjusted by Ofgem, we set out an stylised illustration below.

Suppose a company has book value net debt of 150, RAV of 250 and hence regulated equity of 100. It would therefore have a RAV gearing of 60% (150 divided by 250). Further suppose that the market value factor on its debt is 1.04, i.e. the fair value of the net debt is 156. And also a market value of equity of 125. Taken together, this would imply an EV (based on book value net debt) of 275, and an EV (based on the fair value of the debt) of 281. This final value is the fair value of the capital.

All the relevant parameters and the associated different gearing measurement are shown Figure 1 below.

Figure 1 Ofgem's gearing level adjustment

Parameters	Value
A: Net debt book value	150
B: Market Value Factor on debt	1.04
C: Net debt fair value =A*B	156
D: Equity (regulated value according to RAV)	100
E: Equity market value	125
F: Total RAV =A+D	250
G: Enterprise Value = A+E	275
H: MAR =G/F	1.1
I: Fair Value of the capital =C+E	281
J: RAV gearing = A/(A+D)	60%
K: Enterprise Value gearing =A/G	55%
L: Fair Value gearing = C/I	56%
M: Ofgem's adjusted gearing = K*H*B	**62%**

Source: For illustrative purposes only

As can be seen from the table, in our example the RAV gearing is 60%, the EV gearing (using book value debt) is 55% and the FV (fair value) gearing is 56%. As explained above, the finance best practice is to use the EV gearing (or FV gearing where possible) to de-gear estimated benchmark equity betas.

However, Ofgem's proposed formula creates an artificially high level of gearing (62% in our example) which is neither RAV gearing, EV gearing nor FV gearing. In our view, this is simply the wrong level of gearing to be used to de-gear the equity betas, as it does not have any meaningful economic interpretation.

3 THE MAR GEARING ADJUSTMENT AS A REGULATORY INSTRUMENT IS MISPLACED

In this section we explore the potential regulatory implications of Ofgem's proposed method, based on the presumption that its intent is to prevent an EV above RAV (i.e. a MAR >1) from emerging going forward. We consider that this provides a range of further reasons to believe that Ofgem's methodology is misplaced and wrong, because:

- it relies on MAR from a different sector with different regulatory arrangements and characteristics;
- Ofgem cannot know what causes any MAR premium – and not all causes require the same treatment;
- it has detrimental effects on incentives that have not been considered;
- it double counts with other adjustments proposed; and
- it cannot be legitimately carried out in a symmetric way.

3.1 Using water company MAR for energy networks is inherently risky

It is evident that Ofgem bases the size of its MAR adjustment on evidence from the water sector (see for example Figure 10 from the Finance paper of the Sector Specific Mythology Decision). Using water companies MAR to adjust allowed return for energy network company returns could introduce arbitrary noise into the methodology.

Although the regulated water sector has a broadly similar regime the regulated energy networks in the UK, the fact remains that Ofgem does not have control over the water regulatory regime. The MARs of water companies ultimately depend on the calibration of Ofwat's regulatory regime and companies' own operational risks. Using water company MAR to adjust the gearing level for all comparators in the beta sample (noting specifically that not all are water companies) would create the risk of adjusting for this key measure of the risk of energy networks to take account of factors that may be irrelevant to that sector.

In the context of the RIIO T2 price control, this issue becomes particularly pertinent, as the regulated company in question do not necessarily have a MAR similar to that of the water companies used in this proposed adjustment. Ofgem's proposed method, if used as a remedy for high MAR, would be targeting a problem that does not necessarily exist, at least for RIIO T2.

Ofgem has sought to defend its calibration of the MAR adjustment according to evidence from the water sector by pointing to the premia observed on energy network transactions. We do not consider this to be a reliable cross check. The premia observed on private equity transactions are likely to contain additional premia (such as control premium, option value for the potential use of securitised structures, etc.) and may be affected by a Winner's Curse. Moreover, they reflect

only the information available to bidders at a given point in time, and will not reflect well the potential effect of Ofgem's ongoing development of RIIO-2. There is no reason to believe that a transaction premium realised before the development of RIIO-2 began in earnest can be used in the way Ofgem intends.

We therefore find Ofgem's use of water company evidence unreasonable and likely to lead to error.

3.2 Inability to diagnose the cause of the MAR

Notwithstanding the fact that Ofgem is unable to observe a timely measure of energy company MARs, even if it could do so it would be unable to confidently diagnose the cause of the MAR being higher than 1.

In the UKRN paper, Burns explained the possible drivers for the bid premia for regulated utilities – MAR for the publicly listed companies.[7] In summary, the EV (and hence MAR) can be affected by two underlying factors:

- expected future net cash flows; and
- underlying discount rate.

The former can drive a high MAR if expected future net cashflows is positive due to investor optimism on efficiency gains and incentive payments. The latter can drive a high MAR if the underlying discount rate is lower than the allowed rate of return. Due to the unobservable nature of either of these two factors, an observed MAR can never be disentangled into the above two effects with certainty. This means that Ofgem cannot determine the cause of the MAR before using the MAR gearing adjustment.

If the true cause is the expected positive future cashflow, then an automatic mechanism to neutralise MAR through an adjustment to beta would be highly misplaced. It would in effect lead to two inappropriate calibrations, i.e. setting allowances/targets too high, while at the same time setting the cost of capital too low. In order to lead to a balanced regulatory outcome, Ofgem would need to be confident that these two errors largely offset one another, which would be extremely hard for the regulator to achieve given:

- uncertainty over the existence or quantum of any EV premium over RAV for energy networks; and
- the origins of that premium should it exist.

In our view, deliberately calibrating a price control that contains offsetting errors is at odds with the principle that regulation should be properly targeted and is likely to weaken regulatory transparency and predictability.

3.3 Damaging incentive properties

Ofgem's MAR adjustment has the potential to weaken incentives to seek outperformance in the first instance, Notwithstanding our observations above

[7] Wright, Burns, Mason and Pickford (2018) – Estimating the cost of capital for implementation of price controls by UK regulators, Appendix J.

regarding how challenging it may be to observe energy network MARs, identify their origins and then make a finely balanced adjustment to allowed returns, Ofgem is essentially seeking to establish a calibration rule whereby any anticipated future outperformance that is crystallised in EV above RAV is automatically eliminated through an offsetting adjustment to WACC. What is not clear is why, in the existence of such a rule, a network company would strive to achieve some marginal improvement in performance, given that it will simply be confiscated. Over time, applying such a mechanism has the potential to very materially weaken incentives for performance improvement, and is therefore unlikely to be in the interests of any stakeholders, in particular those of the customers. This would achieve exactly the opposite of Ofgem's long-term regulatory objectives of driving efficiency and service quality for the benefit of customers.

We also note that this adjustment has the potential to result in an artificially low cost of capital allowance . Since the cost of capital allowance acts as the primary incentive for networks to invest, Ofgem's adjustment may have profound effects on the day-to-day business case for investment appraisals undertaken by all network operators. Investment that should rightly proceed may no longer pass a cost benefit analysis.

There are clear parallels with Frontier's previous work on ER versus AR (prepared for the ENA, "Adjusting baseline returns for anticipated outperformance"), where we explained the various detrimental effects of Ofgem's proposed 50 bps adjustment on the allowed return on equity on the account of expected future cost outperformance. Effectively, the MAR gearing adjustment would achieve broadly the same result, and be exposed to the exact same drawbacks of the 50 bps adjustment on the baseline returns. In other words, Ofgem would be making an adjustment that materially weakens incentives to improve all aspects of performance and also distorts a primary incentive for networks to invest.

3.4 Double counting

Since Ofgem proposes to carry out the 50 bps adjustment and the MAR gearing adjustment at the same time, this effectively commits the same mistake twice. Even if one of the adjustment were justifiable, and we do not consider this to be the case, carrying out both the ER vs AR adjustment and the proposed MAR adjustment would lead to an obvious double counting error.

3.5 Lack of symmetry

Finally, as a regulatory methodology, it is questionable whether the MAR gearing can pass the basic legitimacy test if applied in a reverse situation. The long run principle is that this MAR gearing adjustment systematically adjust the MAR towards 1, but would Ofgem be able to justify an adjustment the opposite way when required?

More specifically, imagine that due to bad management, bad regulation, or a combination of the two, investors lose confidence in the company and the market value drops below the RAV, the MAR gearing adjustment would lead to higher allowed return on equity than the actual cost of equity, effectively bailing out bad

management and/or bad regulation. Ofgem would face equally fierce criticism from consumer bodies and various other institutions as to how such methodology can be considered appropriate, especially when Ofgem would face equal challenge to prove that the MAR being lower than 1 were not due to bad management and/or bad regulation.

Inevitably failing to provide such proof (as again it is unobservable), Ofgem would then need to back track from applying this method, which means that the MAR gearing adjustment could really only be made to work in an asymmetric setting as a stealth tax on high performing companies. However this is not how Ofgem currently justifies this method.

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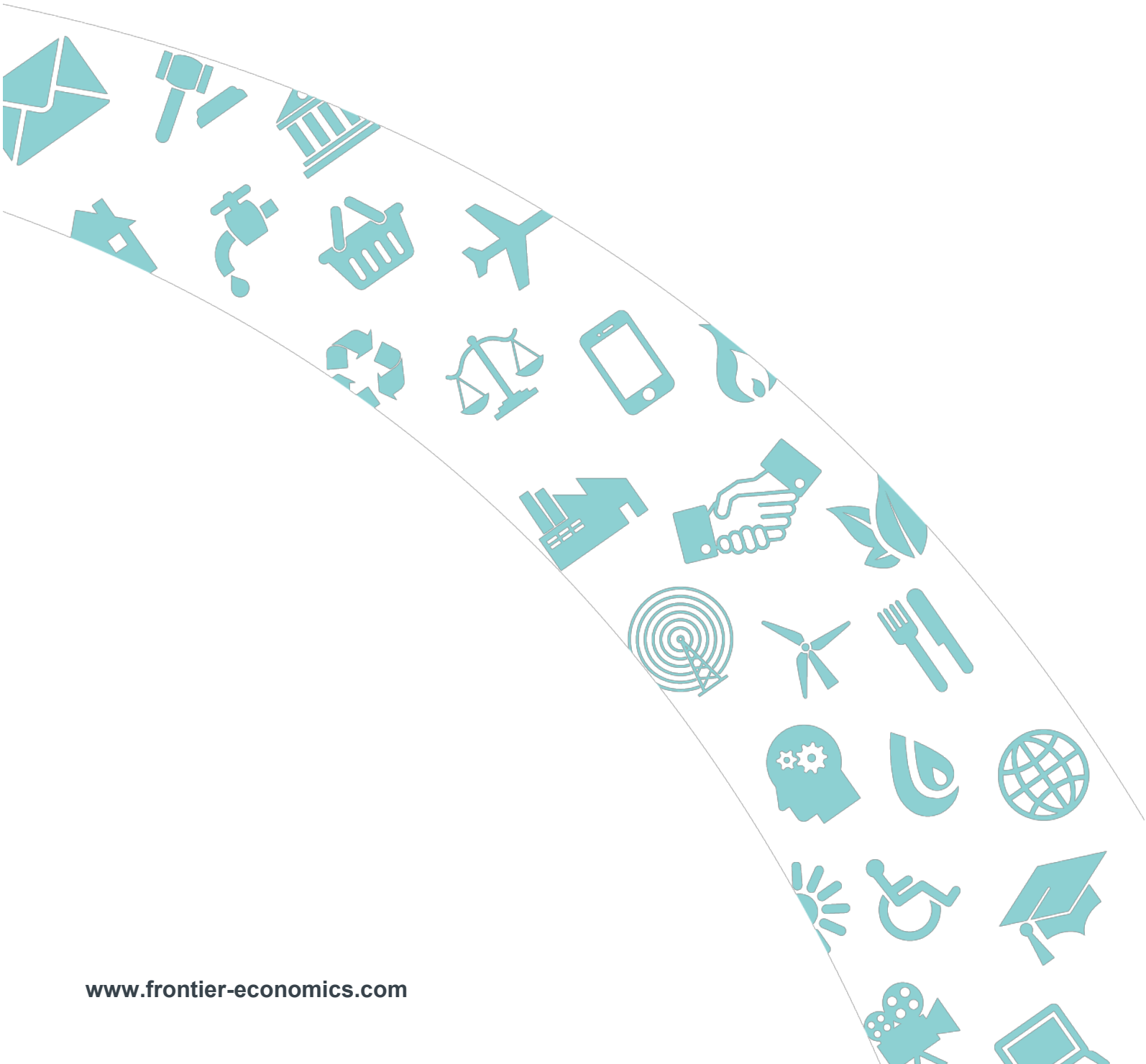

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