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Valuation of Water Resources of Russia

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***Abstract*— This Paper is focused on the methodology for water resource valuations in conformity with the System of National Accounts (SNA 2008) principles. We offer a residual estimating technique based on resource rent capitalization and apply it to generate experimental estimates for the Russian surface and ground water resources for the year 2013– on the statistical macro-level of analysis. We report the findings of water rent estimates on the capitalized and un-capitalized basis, as well as unit valuations for water abstractions – as differentiated by the major water-using industries accounting for more than 60% of the water abstraction in the country. The technique provides a differentiated treatment for what we call –mono-industries" and –mixed-use industries" and urges the importance of not neglecting the contributions from the latter in valuing water resources for SNA purposes.**

Keywords*— *water resources, assets, rent, valuation techniques, value

I. INTRODUCTION

In 2016, the authors have been commissioned to develop Guidelines and conduct experimental estimates for incorporating the value of national water resources into the National balance sheet in conformity with the SNA-2008 framework [1]. This work has been performed in furtherance of a parallel 2014 Rosstat project [2] to account for the value of Land resources on the National balance sheet in order to reflect more comprehensively the extent of the National wealth using SNA-2008 classification of asset classes. The outcome of this project was represented by Guidelines for valuation of water resources at current market prices through capitalization of water rent derived by the main water-using sectors of the economy [3]. These Guidelines have been trial-tested on the basis of experimental macro-level estimates for the overall value of the national water resources, as well as exploring their applicability on the river-basin (i.e. «micro-level») basis (with the respective value estimates/water accounts obtained for the Pechora, Don and Ob' river basins).

II. THE THEORETICAL PART

Nonetheless, SNA 2008 mandates that valuation of water resources for asset accounts should be conducted on the basis of general asset valuation principles (including those for mineral resource valuations) provided in SNA (pp. 13.16-13.25), but mentioning that other more practicable alternative approaches may also be utilized -- such as sole reliance on the capitalization of water use/abstraction charges levied by the titular owner (the state) absent the better estimates (p. A3.85). However, in SNA there is a putative hierarchy of approaches lined in the continuum of their —market-orientedness". That is, similar to international accounting measurements under IFRS (e.g. the International Financial Reporting Standard 13 –Fair Value Measurements"), the mentioned SNA asset valuation principles prioritize the use of observable market data on resource prices where those are abundant enough (i.e. the pursuance of the market approach to resource valuation), but also – as a —second-best" option status-- permit the use of the cost approach techniques (which, in unrefined form, are mostly relevant to produced assets only), as well as income approach methods (the Net present value method (NPV), which is the workhorse of mineral resource valuations, and associated capitalization techniques) – where direct market price comparisons to infer the resource value are in thin supply. Further -- to condition the application of those approaches -- an important SNA principle is that natural resources, including water, should be valued at their in-situ value -- that is in –as is" condition, but not in some refined state for which their prices are indeed most often available.

But given the absence of market-based raw-state pricing for water resources in Russia, falling back on the capitalization of water rent as a version of the residual (net present value -style) method of valuation is immediately self-suggestive —also given the respective precedents for the choice of this method for SNA valuation purposes in Netherlands, UK and Australia, e.g. even in those jurisdictions where water- resource pricing is more responsive to market signals and raw-water markets actually exist (i.e. in Australia). A variety of the cost approach – i.e. the least costs method – has also been considered by us and applied in the instance of one important water-reliant industry (hydroelectricity generation) as a back-up method to corroborate estimates obtained through water rent capitalization. On the other hand, it is a well-known lapse of the rent capitalization techniques that, where the estimated rents they return are zero- or negative- valued, the method itself ceases to be useful (since water value is bounded at zero and, being a public asset, can't be negative- valued). In such instances, we believe that negative industry-wide rents indicate that resource fails to generate any rent and should therefore be zero-valued in the

context of that industry in economic terms. We refrain from pursuing other roundabout methods of valuation (e.g. those least-costs-of-substitution ones proposed in Edens & Graveland (2014)) where the estimates return zero or negative-valued economic industry rents, and consider such instances as zero-valued uses of water. We also chose to aggregate in industry-wide rent calculations only those enterprises which have positive rolling-average operating performance indicators on which economic rent estimates are based (i.e. the industry-wide sample is purged of enterprises with a priori negative rents). This is justified on the basis of the Ricardian notion of differential rent, where the rent is viewed as any overage, or surplus, above the basic acceptable conditions or reproduction—continuously recorded negative operating surplus in that sense is not a viable ~~c~~ondition of reproduction".

Given this approach, it is clear that our aim is not to obtain the maximum, but best-substantiated assessment of the value of national water resources for statistical purposes, subject to the assumptions and limitations of the analysis listed below.

III. The technique for estimating the value of water resources employed

The value of water resources is determined as the sum of capitalized resource rents derivable by entities within the principal water-consuming industries (mono and mixed-use) and capitalized rent received by the state in the form of water tax and water-use paymentsin accordance with the methodology of international standards [12 - 16]. The calculations used the data of Rosstat [16] and The Ministry of Natural Resources of Russia [18], The Federal Water Resources Agency [19].

IV. Findings from the experimental estimates

In the result of our experimental water resource valuations, the overall value of water resources for Russia has been estimated at 3.93 trln. rubbles at the start of the year 2013 Or around USD 150 bln. if estimated at PPP exchange rate of some 25 rubles to the US dollar (or at about 5,5% of the Russian GDP at 2013 current prices) . Out of which 3,28 trln. ruble value falls on account of the surface water resources, and 0,66 trln. ruble. accounts for the value of the ground water.

This can be treated as a minor component in the structure of the national wealth. It represents short of 1,5% of the value of the produced capital in Russia.

The breakdown of water resource valuation estimates between the surface and ground water categories for the year 2013, being the year for which we undertook the experimental estimates, is presented in TABLE I.

Comparison of the estimates derived with the value of water abstraction rights prevailing on the US market (based on the unit market prices reported for sales of short-term water rights in agriculture for 11 Western semi-arid US states)—see TABLE II—indicates the closeness of estimates and similarities in the order-of-magnitude, which is the additional supporting justification for the soundness of the estimates of water rent obtained for the Russian water resources – since, whatever the strictures on the usage of the benefits transfer method in the SNA-compliant natural resource valuations, the sales comparison (market) approach to valuation is the ultimate touchstone of the robustness of valuations reported.

TABLE I. Experimental macro-level valuation of the Russian water resources for 2013

Level of valuation	**Value of water resources as at 01.01.2013, in bln. rubles , at current prices**		
	Ground water	***Surface water***	***Total for water resources***
The Russian Federation	657,8	3 277,0	3 934,9
	17%	83%	100%

Source: author estimates

TABLE II. Median unit value of water abstraction rights on the US water market, as determined on the basis of recorded transactions in which short-term water rights (1-year leases) were sold by the agricultural sector to municipal water-users, data for 1987-2005

State	**$/acre-foot**	**$/cubic.m**
Arizona	55	0,045
California	83	0,067
Colorado	29	0,024
Idaho	2	0,002
Montana	18	0,015
Nevada	24	0,019
Oregon	6	0,005
Texas	19	0,015
Utah	92	0,075

Source: Brewer et al, 2007; as adapted in Young & Loomis (2014), p. 235

TABLE III depicts the diagram with the unit valuation of water abstraction for industries in Russia for the year 2013, which is based on the derived industry-level water rents and the volume of water abstracted from the surface and ground sources.

TABLE III. Unit valuations of water abstraction by industries 2013, US cents at PPP/cubic.m

Industries	**Rent valuations of water**
Inland Fishing	1,6
Energy generation on thermal plants	2,8
Crops Agriculture	2,8
Production of coke and oil products	10,9
Cellulose industry	14,8
Animal farming	24
Production of mineral waters	29,4
Alluminium production	72,8
Mining & enrichment, Non-ferrous	118,4
Castiron, steel and ferrous alloy production	124,8
Chemical production	139,2
Production of synthetic fibres	181,6
Mining & enrichment, Ferrous	188,4

Source: authors' estimates

V. CONCLUSIONS

The level of water rent generated in Russia as a whole points to overall economic efficiency of operating and investment costs borne by the water-management sector (i.e. more than 200 bln. rubbles per annum, or about $3,5 bln. at the current market exchange rate).

The analysis we undertook also provides an economic justification, or illustrates the case, for the increase in statutory water-use charges -- as the share of water rent captured by the state through the existing water taxes and contractual water use charges falls short of even 10% level on the country-wide basis.

The elicited high degree of differentiation of macro-level unit valuations for water rent (on water abstraction basis) – from under 1 ruble per cubic m. of abstracted water in agriculture, to 750 rubles per cubic m. in the mineral water bottling industry – attests to the untapped possibility for switching to the industry-differentiated structure for statutory water-use charges, instead of pursuing the flat-rate water taxes/contractual charges.

More detailed results of the study are presented in the works of Medvedeva and Artemenkov [20, 21].

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