NOMOLOGICAL VALIDITY OF NATIONAL INTELLECTUAL CAPITAL MEASURES

O.N. Lazuka, M. Sc., Lund University, Lund, Sweden

Discussing policy implications of their new set of national intellectual capital (NIC) indices Lin and Edvinsson (2011), claim that the proposed measurement model "helps nations identify key intangible factors for future competitiveness and wealth creation" and provides "an abundance of hard-core information for policy-makers" [1, pp. 368 – 369]. In this case, likewise other researchers, which developed measurement schemes for intangibles, authors have preconceived ideas that suggested measures are capable of grasping the dynamics of NIC in connection to economic growth. This claim appears ambitious if one takes into account that all proposed NIC indices have not been validated in a strict accordance to the test theory. However, the validity of NIC measurement models concerning economic effects is questionable. This constitutes the research problem of the study.

Measures of intellectual capital are not lacking in grounded theory. Even though macroeconomic research on intellectual capital is young and still developing, its bordering theories are long-established and proved themselves as comprehensive theoretical tools. Thus, NIC approach tends to share ideas and demonstrate implications similarly to various approaches to intangibles. Within neoclassical traditions, it is the Endogenous Growth Theories, e.g. [2; 3], which resemble strongly with basic statements of intellectual capital and its current line of research. Due to this diversity of applied approaches, current NIC studies differentiate a lot in interpretation of the major concepts. As a result, the choice of indicators which attributed to these concepts varies strongly. In addition, application of macro measurement models directly from micro intellectual capital studies that originally have some flaws creates conceptual and methodological diffuseness. Therefore, concerning intellectual capital research validity should be questioned not only because theory is not conceptualized, but also because scholars tend to misuse it in empirical studies.

According to the stated research problem, a particular type of validity – nomological validity – of NIC measures is aimed to be examined. By the measurement literature, nomological validity is referred to the construct's ability to correlate with other theoretically related constructs, thus variables with which in theory it should be correlated [4]. As to nomological validity of NIC measures, following NIC scholars, in the current study it is considered that NIC should correlate with future economic performance, and its effect should be distinguished from other factors in the model; further, it is supposed that intellectual capital affects the rates, rather than the levels of economic growth [5].

Macroeconomic research on intellectual capital as an economic driver appears to have two lines of thoughts while considering growth theories, proposing either embodiment or disembodiment hypotheses. First, embodiment researchers developed

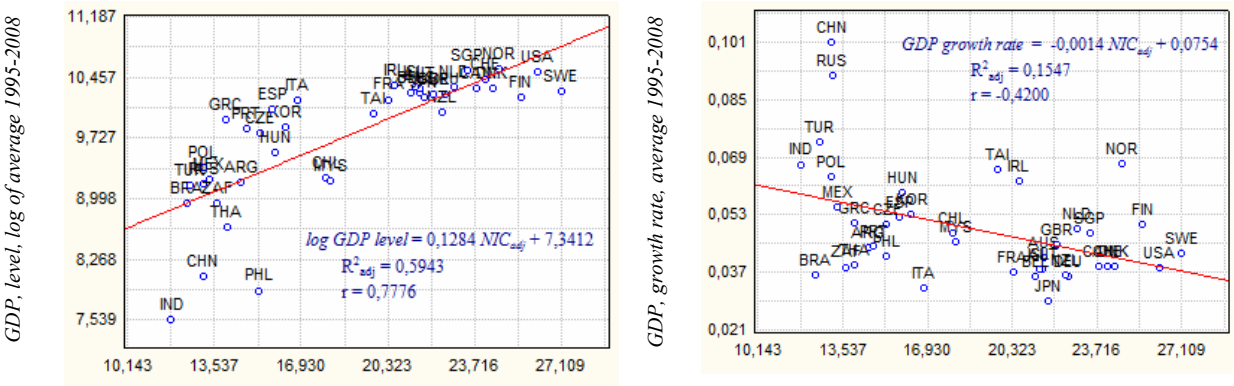
augmented production function with capitalization of intangible investments and hence attempted to embody residual into capital or labour, e.g. [6]. These studies are grounded in deep traditions of measurement of firm-level intangible assets using financial data and their linkage to aggregate productivity. Although categorization of intangible capital can be criticized, on the basis of purely financial data, they provide an adequate technique that has been recently used by satellites of national accounting programmes, which attempt to measure more broadly immaterial investment. Second, disembodiment researchers consider the necessity to separate economic effects of NIC from effects of other traditional factors of production. In this case, dynamics of intellectual capital is measured either with numerous separate indicators [5] or with composite single index constructed on their basis [7; 9]. The major notion of this research is that intellectual capital, as a heterogeneous phenomenon that includes primarily value-laden attributes, can be measured only with both quantitative and qualitative data. Indeed, this perspective can be seen as prevailing in future research on economic effects of NIC since it offers suggestions how to bridge accounting focus on quantitative monetary assets and investments and reporting focus on qualitative non-monetary values and metrics [8].

While promoting the investigation of dynamics of intellectual capital with composite indicators, researchers have achieved diverse results. In their estimation of the intellectual capital of the EU, for instance, Andriessen and Stam (2005) found no significant correlation between GDP and intangible stocks [7]. In his study for Arab countries, Bontis (2005) demonstrated that NIC measured with proposed index accounts for nearly one-fifth of the financial wealth [9]. However, the results from this study could be perceived as unreliable as the sample countries are too small, and in addition, data on indices is cross-national. In this vein, Lin and Edvinsson (2011) recent study stands in a stark contrast, since it appears to be adequate in formal attributes for investigation of economic effects in a promoted perspective. That being so, in their measurement of forty developed and developing countries with longitudinal data they established a significant average correlation of 0,88 between proposed composite NIC indices and GDP per capita [1, p. 315]. Therefore, the Lin and Edvinsson (L&E) measurement model, that represents a prevailing perspective in NIC research, is a perfect subject for further investigation of nomological validity while testing disembodiment hypothesis.

Nomological validity of L&E NIC measures has been tested in their predictive power for future economic performance in log-log and log-linear simple and multi-regression models. In accordance with theoretical statements, initial level of economic growth has been used as a control variable. Data on economic growth measures has been drawn from World Bank, since this database covers variables for all elements of the sample. As suggested by Growth Theory literature, GDP per capita adjusted by the current purchasing power parity for all 40 countries (1995-2008) has been captured.

As the estimation shows, initial levels of NIC measured with L&E indicators correlate significantly with both levels and rates of economic growth, but with differ-

ent strength (see figure). Thus, L&E NIC indices for a current period correlate rather weakly with future growth rates of GDP: correlation coefficient reaches 0,42 and being significant. Correlation between measures of current NIC and future levels of GDP equals 0,78, thereby being significantly strong. Respectively, an explanatory power of the former model is much lower, whereas variation in NIC measures explains 60 per cent of variation in levels of GDP. On account of this, in comparison to other analogous studies, evidence demonstrated with L&E NIC measures in its connection with rates and levels of future economic performance is striking. However, direction of interrelation between rates of economic growth and NIC levels tend to be conflicting.



(a) *(b)*

Fig. Correlation between current levels of NIC and future economic performance, *(a)* levels and *(b)* rates of growth

40 countries, each with 14 observations. Significant at 0,001 level.

Source: own calculations

Although presence of correlation between NIC and future national performance conforms to the theory, direction of this correlation measured with the L&E indices is inadequate. An established negative correlation between intellectual capital and rates of economic growth confronts to theoretical statements, whereby this relation should be positive. However, when L&E NIC indices are regarded as extended indicators of economic performance, some explanation can be provided for this empirical finding. Likewise with GDP measures, negative correlation between initial levels of NIC and rates of economic growth replicates *catch-up* phenomenon: countries with low level of NIC will eventually catch up with leaders, countries with high levels of NIC; during the period of catching up the latecomer will have a higher growth rate than leaders [e.g. 10]. That being so, empirical evidence with the L&E measures contradicts to statements of the Intellectual Capital Theory, but fits into the Growth Theory considerations in such a way that NIC measures substitute measures of national accounts.

When initial level of economic performance is controlled for, results become even more conflicting. While including initial level of GDP per capita, estimated coefficients for level of NIC in both models with levels and growth rates of GDP are statis-

tically unacceptable. According to general considerations of measurement theory, this can be explained in a way that high correlation between initial level of GDP and current level of NIC (r = 0,77, significant at 0,001) is making it difficult to accurately capture the effect of each indicator. However, as study shows, explanatory power of modified models has increased considerably in comparison to simple correlations; in particular, in case of level-to-level estimation it accounts for 96% of variance in cope with improved F-statistics. All given, there emerges a research dilemma of whether level of NIC should be excluded from the model or not. The measurement theory offers two appropriate remedies for this: (a) either to use the model with highly correlated variables for prediction only, but without interpretation of coefficients, (b) or use the simple correlations between each independent variable and the dependent variable to understand independent-dependent relationships. In all cases, research solution should be supported by the theory.

According to theoretical assumptions, under strong correlation between IC and initial level of economic performance, NIC variables can not be used in any model. Using the multi-regression model with both initial levels of GDP and NIC, which are proxies of tangible and intangible factors respectively, makes it impossible to distinguish their influences on future economic performance. Examining economic effects of NIC in simple correlations also appears to be problematic, since the behavior of NIC indices is identical to national accounts measures for level-to-rate relationships. In addition, this creates some methodological impediments for translating obtained results into policy prescriptions. Thus, at a brief glance, the overall meaning of NIC's beta-coefficients can be regarded rather easily in examined log-linear models: as has been found, when NIC increases by one unit, GDP changes with plus 12,84 per cent in levels and minus 0,14 per cent in growth rates (see figure). However, within deeper analysis, for L&E indices which constituting sub-indicators were originally benchmarked, averaged and then summated it appears to be considerably difficult to generate any constructive conclusions. While extensively used in the L&E, qualitative measures which are naturally compound aggregated indicators are not less troubling for interpretation. Therefore, when a large number of metrics is reproduced arbitrarily in measures of intellectual capital, likewise in L&E NIC indices, retranslation of results tends to be impossible.

To conclude, the study shows that the fundamental idea of NIC as a driver to economic growth may have more empirical support than with its current measures. The major reason for this is that intellectual capital dynamics and impact on economic growth covered with L&E measures do not conform to theoretical assumptions. The NIC L&E indices may serve only as descriptive indicators of macroeconomic performance which do not reflect the NIC concept. This outcome is of particular importance since it points out the appropriation of any international composite indicator to estimate the dynamics, and therefore, elaborate policy recommendations on its basis. That being so, this study points out the priority of theory before empirics in economic science and economic policy.

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ПЕРСПЕКТИВЫ РАЗВИТИЯ «ЗЕЛЕНОЙ ЭНЕРГЕТИКИ» В РЕСПУБЛИКЕ БЕЛАРУСЬ

Т.Ф. Манцерова, к. э. н., доцент, Н.А. Сологуб, м. э. н., Белорусский национальный технический университет, г. Минск, Республика Беларусь

Удорожание импортируемых в страну природного газа и нефти в программах развития отечественной энергетики невольно смещают внимание к вовлечению в энергобаланс страны местных видов топлива и возобновляемых источников энергии. Речь идет о торфе и древесине, а также буром угле и горючем сланце. Первые два вида топлива широко используются, прежде всего, для замещения в котельных газа и жидкого топлива. Однако говорить об использовании бурых углей в краткосрочной перспективе еще рано, так как затраты на их освоение весьма велики. При этом не наблюдается реальных инвесторов, хотя