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Evaluating a continent-wise situation for capital data

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ABSTRACT

This paper investigates the evolution of natural assets and the relationship among natural, produced and human capital, for selected countries of six continents during the 25-year period 1990–2014. The paper employs an alternative graphical data analysis to picture variations and evolution schemes in capital data formation. Our novel contribution is to feature the underlying consumption or restoration of natural capital in relation with intertemporal man-made capital dynamics. The proposed graphical approach (i) has the advantage of being self-evident, (ii) depicts comparative results surpassing the problem of different scaling of the data (iii) examines the interdependence of the three types of capital data (i.e. natural capital, gross fixed capital formation or labor). We aim to uncover each country's environmental policy at a glance and draw conclusions concerning environmental sustainability.

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1. Introduction

Natural capital is a critical asset, especially for developing countries where it makes up a significant share of total wealth.

This paper develops a methodology for identifying countries' policy of exploiting natural capital. We present and examine the dynamics of natural, produced, human capital. We propose a graphical analysis in Mathematica that depicts natural capital stocks in relation with manufactured and human capital levels. Possible interrelations have been investigated analytically in Benhabib and Spiegel (1994), Managi (2006), Managi and Kaneko (2006), Managi and Jena (2007), Dulleck and Foster (2008), Perrings and Halkos (2012), Halkos (2011a), Halkos (2011b), Shao and Yang (2014), Managi and Halkos (2015) and Sakamoto and Managi (2015). Here we provide both individual and comparative schemes for capital formation trends. In one-country schemes, some expected effects as the decrease in natural capital while other capital such as produced and human capital increase (which increase GDP) (Barbier, 2013, 2014) are verified for the vast majority of the countries studied and especially for countries rich in natural capital. In comparative schemes, a spatial analysis is performed by illustrating continent-wise and worldwide situations.

Extending our visual framework with dynamic options, we construct a capital data visualizer to facilitate comparisons among countries of the same continent. Several visualization options are used to reveal the capital investment strategy through time and/or among countries. Two different aspects of capital formation are considered: temporal variation of

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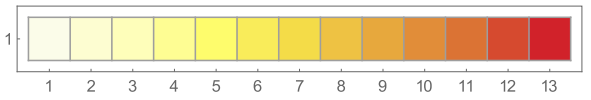
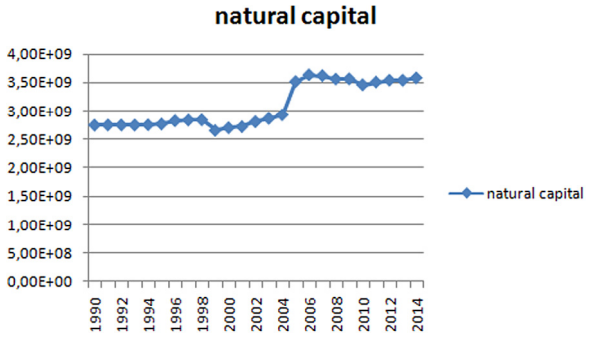
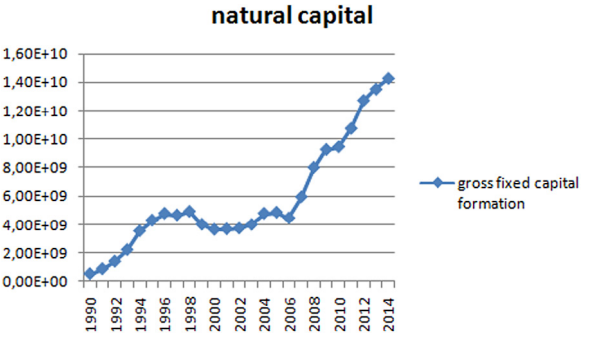


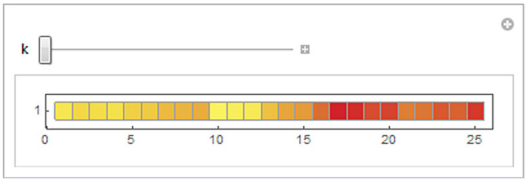
Fig. 1. Visualization of row matrix (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13) using temperature map colors. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)



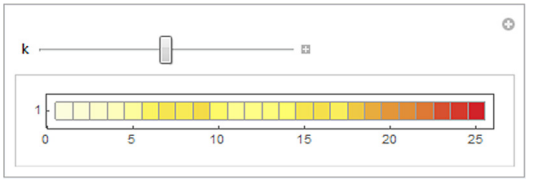
(a) Time series plot in Excel for natural capital data (constant USD of 2005).



(b) Time series plot in Excel for gross fixed capital formation data (current US$).

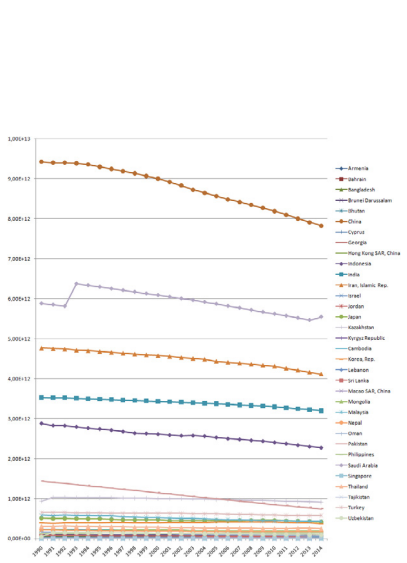


(c) Data visualization in Mathematica for natural capital data.

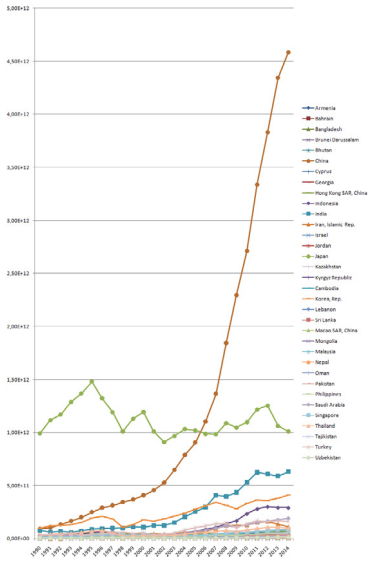


(d) Data visualization in Mathematica for gross fixed capital formation data.

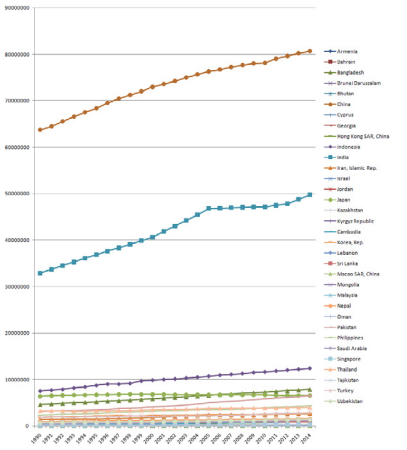
Fig. 2. Explaining our visual framework with images. Data concern the Lebanon case for the 25-year period 1990–2014. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)



(a) Natural capital (constant USD of 2005).



(b) Gross fixed capital formation (current US$).



(c) Labor (thousands).

Fig. 3. Time series plot in Excel for 34 Asian countries (UNEP IWR data) over 1990–2014 time period.

magnitudes and capitals' interdependence. Ranking and/or classification of countries according to their capital assets is achieved at a glance. Integrating the use of animated graphics, the intertemporal evolution of capitals per continent is demonstrated and a year by year slide show is possible.

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