Physica A 389 (2010) 3661–3673

Contents lists available at ScienceDirect

Physica A

journal homepage: www.elsevier.com/locate/physa

Analysis and models of bilateral investment treaties using a social networks approach

Daniela Saban [a], Flavia Bonomo [a,b], Nicolás E. Stier-Moses [c,*]

[a] Computer Science Department, FCEN, University of Buenos Aires, Buenos Aires, Argentina

[b] CONICET, Argentina

[c] Graduate School of Business, Columbia University, New York, NY 10027, USA

ARTICLE INFO

Article history:
Received 8 January 2010
Available online 11 April 2010

Keywords:
Bilateral investment treaties
Complex networks
Network growth models
Social networks

ABSTRACT

Bilateral investment treaties (BITs) are agreements between two countries for the reciprocal encouragement, promotion and protection of investments in each other's territories by companies based in either country. Germany and Pakistan signed the first BIT in 1959 and since then, BITs are one of the most popular and widespread form of international agreement. In this work we study the proliferation of BITs using a social networks approach. We propose a network growth model that dynamically replicates the empirical topological characteristics of the BIT network.

© 2010 Elsevier B.V. All rights reserved.

1. Introduction

Bilateral investment treaties (BITs) are agreements between two countries for the reciprocal encouragement, promotion and protection of investments in each other's territories by companies based in either country. The signing of the first BIT between Germany and Pakistan in 1959 initiated the creation of a network of treaties that has experienced continuous growth. By the end of 2005, 179 countries (out of approximately 200) had signed at least one BIT and there were a total of 2460 BITs in force. Nevertheless, although a significant number of new BITs were signed in the first half of the 1990s, the rate at which new BITs were signed started to decrease afterwards. Indeed, the number of new treaties in 2005 was down 60% compared to 1995. Despite this decrease, BITs are still one of the most popular and widespread forms of international treaty.

There have been many studies aimed at understanding the proliferation dynamics of BITs. Their results are inconclusive and there is a large debate about the reasons why countries sign BITs and the effects caused by their signing [1–4]. Many of these studies assume that the motivation to sign BITs is to improve the chances of receiving foreign direct investment (FDI), although there is mixed evidence in the literature regarding this assumption. In particular, Neumayer and Spess discuss that a higher number of BITs raise the FDI that flows to a developing country [3], and Elkins, Guzman and Simmons argue that the spread of BITs is driven by international competition among potential host countries for FDI [2].

This multi-disciplinary work departs from earlier approaches and studies the body of BITs using a *complex social networks* perspective. A social network is a structure made of nodes that are tied by one or more specific types of interdependency. In our case, nodes represent countries and a tie between nodes indicates the existence of a BIT. Networked systems from the real world have routinely been studied using this perspective. Examples include the Internet [5], the World Wide Web [6], scientific collaboration networks [7], and metabolic networks [8]. These networks are referred to as *complex* because they have a large number of nodes that are connected forming non-trivial topological features. The mentioned connection

* Corresponding author.
E-mail addresses: dsaban@dc.uba.ar (D. Saban), fbonomo@dc.uba.ar (F. Bonomo), stier@gsb.columbia.edu (N.E. Stier-Moses).

0378-4371/$ – see front matter © 2010 Elsevier B.V. All rights reserved.
doi:10.1016/j.physa.2010.04.001

patterns are neither purely regular nor purely random. Since the 1950s, several random network growth processes have been proposed with the goal of emulating the topology of a complex network. The first of these is the random graph model of Erdős and Rényi, which connects every pair of nodes uniformly and independently with probability p [9]. Running this process on n nodes creates a graph $ER(n, p)$ that has approximately $pn(n-1)/2$ edges distributed randomly. With the advent of more powerful computers, the empirical analysis of large, real-world networks has shown that many of them share some fundamental structural properties, such as small-world effect, high clustering coefficient and power-law degree distribution. With these results in hand, scientists started to question whether *ER* graphs gave rise to networks similar to those generated by real-world complex systems.

The study of the social network generated by the BITs departs from related studies in the literature for the following main reasons. First, the full history of the network is compact and available to us. While most works on real-world networks study the network evolution process over a short period of time, typically no more than 10 years, we will study the evolution process from birth to actuality, covering a period of 45 years. Second, while most networks studied in the complex networks literature are large and sparse with potentially infinite growth [10,6,5], the BIT network is small and dense, and has almost reached its limit of growth at node level. The fact that the network is small will allow us to study the local properties of the network such as its cohesiveness (as given by the clique or quasi-clique numbers). An analysis of these properties is not present in most of the existing literature. Third, traditional papers from the literature of social networks view them as static graphs, and concentrate their attention on the analysis of structural properties of snapshots at different times. We will study the BITs using a dynamic perspective, paying special attention to growth processes that generate networks with similar properties [7]. The main two conclusions that can be drawn from our study are that a network growth process based on a combination of preferential attachment and the fitness model is a good fit for the BIT network, and that the reason why less countries signed new BITs in the period 1995–2005 is the existence of some saturation whereby countries had already signed the BITs that were most important to them.

There are other networks representing an interaction between countries that have been studied from a social networks perspective. To cite the most relevant, [11] studies the topology of the *world trade web*, defined by international import/export trade relationships. In follow up work, [12] focuses on a directed version of the network and looks at its evolution. The paper [13] explores the complex relationships between countries in the *Eurovision Song Contest*, by creating a dynamic network from voting data over a ten-year period. The evolution in both of these application domains allows for the relationships to change arbitrarily over time. This means that edges could be added or deleted from one year to the next. On the contrary, our network only admits the addition of edges: once a BIT is signed, it remains signed forever.

This paper is organized as follows. Section 2 starts by describing the dataset and laying out the groundwork by reporting on the structural properties of the BIT network. Section 3 discusses the evolution of BITs over time and explains the difference between the BIT network and the most-commonly studied big and sparse networks. In Section 4, we propose the models that capture the main aspects of the BIT network and measure the goodness-of-fit using topological characteristics. Finally, we conclude in Section 5 with some opportunities for further work.

2. The BIT network

We used a dataset collected by the United Nations Conference on Trade and Development (UNCTAD) [14,15]. It contains all BITs that were signed starting with the first BIT in 1959, up to 2005.[1] The set of pairs of countries that signed BITs can be regarded as a social network, where the countries are the nodes and an edge between two countries is present if they signed a treaty. In some limited number of cases, a dyad of countries signed a BIT more than once. We only consider the oldest treaty when that happens because the new one is usually a revision and a ratification of the BIT. In addition, some countries like Czechoslovakia and Yugoslavia have divided, so they stopped to exist as countries. Since this is a second-order consideration because it is not a frequent event, we consider that the network growth process is monotone and, thus, we never delete a country or an edge from our network. Consequently, we treat newly formed countries such as the Czech Republic and Slovakia as new countries that join the network. Overall, our network contains 2460 treaties signed by 179 different countries.

To study the dynamics of the BIT network, we define N_y for each year $y \in \{1959, \ldots, 2005\}$ as the set of countries that signed at least one treaty before or in year y, and E_y as the set of treaties signed before or in that year. We let $\mathrm{BIT}_y = (N_y, E_y)$ be the state of the network at year y. Fig. 1 summarizes its growth by plotting the number of new countries and new treaties per year, in the period 1960–2005.

2.1. Structural properties

We now study the properties of the BIT network, focusing on the evolution of these properties over time. Comparing our measurements with what is expected for an *ER* graph of similar size, we start to uncover significant patterns in the network. To obtain representative measurements for random graphs, we average results over 50 independent trials. This section often uses graph terminology; readers are referred to [16] for an introduction to graph theory.

[1] For each BIT, the dataset includes the signature date and the date of entry into force. We just consider the year when the BIT was signed.

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات