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On Financial Bubbles and Earthworms: Lessons from Hungary's Rural Pyramid during its Economic Transition

Abstract

In the early 1990s, Former Eastern Bloc countries, including Hungary, experienced a broad transition from centrally-planned economies, managed by party-state bureaucracies, to privatised economies. Throughout the market liberalisation process, the Hungarian market embraced entrepreneurship as a mechanism for generating both private wealth and economic growth, despite a lack of experience and know-how in business management and financial education, made largely unavailable by the communist regime for more than 40 years. On these grounds, several Eastern European countries experienced the rise of Ponzi schemes. The Hungarian earthworm pyramid can serve as an interesting example of the financial pyramids that evolved during the transition of economies. However, some of the characteristics of the Hungarian earthworm pyramid suggest that it was a rather unique case when compared to other Eastern European pyramids during the economic transition period of post-communist nations. Our study concludes that, under different political and economic circumstances, the

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Hungarian bio-humus production by earthworms could potentially become a profitable venture, rather than a source for financial and societal damages.

Keywords: Hungary, financial pyramids, Ponzi scheme, transition economy, earthworms

Introduction

Financial bubbles and pyramids emerge when the price of a commodity or a security sharply increases with no rational economic explanation, before then collapsing. This inflated price does not reflect the practical or economic value of the commodity or security. Financial bubbles and pyramids are situations in which market prices climb over relatively long periods to record levels that deviate from the path determined by fundamental factors, such as expected increases in profits or dividends. Profit-making expectations and financial speculations of investors contribute to climbing market prices (Siegel 2003). A financial bubble is a situation in which high prices are temporarily maintained due to the enthusiasm of investors or due to price speculation, rather than a consistent estimate of the real value of goods (Shiller 2013).

Financial bubbles often possess similar inherent dynamics. Filimonov et al. (2017) presented a model that describes the dynamics and the development patterns of financial bubbles and identifies the period in which bubbles may burst with high likelihood. This model was successfully tested on three historical cases: the rally and the crash of US stock markets in 1987, the *Dot Com* bubble of 2000, and the Chinese bubble of 2014–2015.

An alternative perspective on the financial bubbles presented by Duménil and Lévy (2011) suggested that financial crises, evidenced by the collapse of financial bubbles and damage to both shareholders and households, are rooted in a far more crucial economic change, namely the recent crisis of neoliberal capitalism, and, more specifically, the end of the US hegemony in shaping economic policies that are based on it. Following this route of argumentation, Harman (2009) and McNally (2011) posited that the growth of financial institutes is beyond their capabilities to sustain financial bubble bursts. In these scenarios, the reliance on the capitalist pillar of *invisible hand* fails, which leads to broad economic damage.

Whether the classical economic models or the alternative analyses prevail, in most cases the term "bubble" represents a strong speculative motive of investors that inflates the prices of traded assets. When a financial bubble inflates by reaching high prices in comparison to the real economic value of the good, it bursts by changing the direction of prices from ongoing increases to sudden price decreases – usually in a rapid, unexpected and volatile manner – until the price reaches a more realistic level or below. Financial bubbles most often occur prior to a financial crisis (also known as bubble burst) that may spread and affect broad segments of the national and international economies beyond the financial sector. Financial bubbles are the result of coordinated interactions at the microscopic level between economic agents, causing the observed price trajectory of an asset to decouple from its underlying fundamental value (Demos and Sornette 2017). Minsky and Hyman (1974) suggested the importance of loose monetary policy in enhancing the price decoupling during bubbles. Innovations, both financial and technological, also tend to be associated with beginnings of bubbles, due to the profit-seeking motives of investors in novel technology and lack of information on their returns (Schubert 1988).

Though collapsed financial bubbles tend to be called "Ponzi schemes", the organisation and constructs of both phenomena are different. Financial bubbles may involve a large, uncoordinated group of investors who allocate a high value to a selected asset. On the contrary, Ponzi schemes are the brainchild of a small group of individuals who promote them in public. The Ponzi scheme is an investment fraud scam which was successfully used in the US by Charles Ponzi. Ponzi took in approximately $200,000 a day, but his business finally crashed when the Boston Globe exposed him in August 1920 (Bhattacharya 2003). This scheme was essentially based on granting high returns on investment paid to new investors that reflected large and unstable interest rates, with Frankel (2012) suggesting that "the first two components of such offers are very high returns and no risk. All Ponzi schemes share this very effective draw of an unusually high promised return" (p.23). In practice, the scheme was fuelled by the increasing number of investors crowding-in with expectations for high profits that financed the payments to former investors by their new money flows. Therefore, the Ponzi scheme sustained itself while new investors continued to join, or until the scheme's leader disappeared with the remaining funds. Historically, this concept was described by Charles Dickens in two of his mid-19th century novels (*Martin*

Chuzzlewit and *Little Dorrit*), which preceded Ponzi's operations by more than half a century (Markopolos and Casey 2013).

Some researchers classify Ponzi schemes as a subgroup of financial bubbles (Garber 2001; Toms 2015), while others suggest that the relationship is more subtle due to the financial and behavioural attributes shared by both (Blanchard and Watson 1982; Shiller 2003). The similarities between the two include over-estimation of basic asset prices and attracting investors who remain in the market for fear of losing highly-profitable opportunities even when there is a consensus that prices are inflated. The main difference between financial bubbles and Ponzi schemes is that, in a financial bubble, the actual price of an asset is high in comparison to a positive fundamental asset value, due to the tangible economic value of the asset. In a Ponzi scheme, the fundamental asset value is virtually null, as it is based on an asset or resource that is either grossly overvalued by its promoter or successfully reflects a figment (Sadiraj and Schram 1999; Clauss et al. 2009).

Additionally, financial pyramids (sometimes called "pyramid schemes") describe a multi-level marketing (MLM) construct (Vander Nat and Keep 2002; Keep and Vander Nat 2014) that can serve legitimate marketing purposes by expanding the sales force and the reach to potential clients. At the same time, MLM participants are motivated to recruit new salespersons, who in return share their revenue with their recruiters. MLM participants can, therefore, generate two streams of income: directly from their own sales and indirectly from the sales of the salespersons they recruit. Some MLM structures limit the revenue-sharing mechanisms only to the layer above the salesperson, while others generate a multi-layer revenue sharing scheme that pays to all the recruiters above the salesperson a decreasing share of the revenue as they become more distant. Examples of MLM companies are Avon, a cosmetics company, and Tupperware, a supplier of kitchenware and home products. Legitimate MLM operations involve ongoing business-to-consumer sales of appropriately priced physical goods; however, Ponzi schemes trade financial products or physical goods with high yield and overinflated financial values that are unsustainable over time.

Whether referring to financial bubbles, Ponzi schemes or to financial pyramids, it is important to investigate the causes of their development, and particularly the dominant role played by the psychology of investors, which affects their initiation, spread, and growth patterns. While stock markets are volatile to an extent because of their nature, financial bubbles and pyramids

contain unsustainable patterns of changes in prices, investor expectations and money flows (in these respects they differ from the sustainable and long-living MLM companies presented above, such as Avon and Tupperware). Additionally, the value of investment assets is nullified in Ponzi schemes. Therefore, it is important to identify key characteristics that can alert investors to financial bubbles, Ponzi schemes or financial pyramids at early stages of their development so as to minimise both private losses and social costs.

This paper aims to analyse the conditions that enabled the development of the Hungarian earthworm bubble during the economic transition period of the nation between the late 1980s and the early 1990s. The paper studies the social behaviour mechanisations that supported the emergence of the Hungarian earthworm bubble and aims to compare its attributes with other financial bubbles and pyramids. As a basis for this comparison, the paper also presents the dynamics of financial bubbles and pyramids in various historical episodes and evaluates whether the Hungarian case could be considered as a "pure" pyramid or bubble, or whether this case could have potentially developed into a profitable enterprise under different social and economic conditions.

Theoretical Background

Economic Analysis of Financial Pyramids and Bubbles

The first recorded crisis caused by a financial bubble burst was the Dutch tulip bubble from 1634 to 1637, often called "tulip fever" or "Tulipmania". These nicknames strongly characterise the investor behaviour that led to the emergence and sudden collapse of a financial bubble that developed during the Dutch golden age of the 17th century, when prices for tulip bulbs climbed between 1634 and 1637 until they reached unbelievably high prices in February 1637, growing by approximately 6,000%. Prices crashed shortly after, thus ending the bubble's 3-year cycle. Tulips rapidly increased in popularity amongst the Dutch population in the lead-up to Tulipmania. They became a status symbol, resulting in exceptionally high prices for tulips and their bulbs.

During the peak of tulip fever, a record price of 6,000 Florins was paid for a bulb of the most famous species in Haarlem (when the average annual income was only 150 Florins). Tulips were exchanged for land, livestock, houses, and for other bulbs that had just been planted, or for future contracts on those that were to be produced. In February 1637, traders noted that the price of tulips could no longer increase, having reached its peak, and started selling them. Loss of trust in tulips as tradeable goods that were able to sustain high price levels and yield significant returns led to a decrease in demand and, ultimately, to panic. Said situation resulted in the burst of this financial bubble, substantial losses and financial devastation for investors. The Dutch government and court refused to interfere in the market due to the speculative character of the investments that was identified in the sudden and rapid rise in tulip bulb prices and the lack of certainty about the characteristics of the flower that could have grown out of each bulb.

While the Dutch tulip bubble was the result of a technological innovation owing to the appearance of new tulip species that were brought from the New World, various Ponzi schemes emerged in the early 1990s in Former Eastern Bloc countries due to the collapse of the Communist regime and the transition to a market economy. More than 600 Ponzi schemes were reported in Romania. The largest was Caritas, which attracted 20% of the population to invest in a financial fund that manifested an 800% return within 100 days (Verdery 1996). Other Ponzi schemes emerged in Bulgaria, Slovakia, Serbia and the Czech Republic (Koleva and Vincensini 2002; Berglöf and Bolton 2002; Buček 2010).

The most known and studied was the Albanian Ponzi scheme, which led the nation to a severe national financial crisis when it collapsed in 1997. Its organisers, Kademi, Driza, and Xhaferi, promised its investors a 100% return on investment within six months. The total amount of investment in their funds amounted to four times the national budget of Albania, and was close to its GDP. When their funds collapsed, approximately one-sixth of Albania's population lost their life savings and the events were followed by violent civil unrest.

The main feature characterising the Albanian Ponzi scheme was the role played by the ruling class and the state in promoting the scheme and encouraging citizen participation. State TV actively promoted these funds, providing the impression of official approval and a guarantee on the investments. Additionally, the funds were publicly recognised as a legitimate

channel for investments by political parties. For example, some parties included fund logos on their election posters. When the funds crashed, the government accepted the "moral responsibility" and returned approximately $370 million to the citizens who had invested in them – a vast amount in comparison to Albania's annual budget of $500 million at that time (Bhattacharya 2003). A post-mortem analysis of the Albanian Ponzi scheme revealed two types of investors: informed and uninformed investors. Informed investors were those who had governmental influence and attempted to maximise their earnings by utilising their positions of power to attract as many participants as possible to the scheme by, for example, providing the funds with public legitimacy and credibility in the media. Uninformed investors were the "common people" who were targeted by those messages and were drawn by the promise of rapid and secure wealth generation, investing their own savings and salaries in the promoted funds (Sadiraj and Schram 1999; Bezemer 2001; Kajsiu 2010).

Behavioural Concepts of Financial Pyramids and Bubbles

Expectation theory suggests that financial bubbles are, in essence, rational because the asset prices reflect the expectations of investors (Flood and Hodrick 1990). In economic terms, financial bubbles can be explained as follows: they begin to form when companies are established with the aim of utilising novel markets, or when individuals crowd-in for potential profits. The key driver of high price growth is the rise of expectations that prices will continue to increase, thereby generating ongoing profits for asset owners. Nonetheless, apart from the effects of objective economic forces that are reflected in the price levels of assets, the development of financial bubbles is closely related to the emergence of irrational expectations from investors. These are largely affected by the psychology of the market and its dynamics, as well as the resultant impact on investor decisions. The decision to invest in an asset that is characterised by a rapidly rising price is thereby a particular behaviour (i.e. a decision or an action) preferred by each risk-taking investor over many other alternative behavioural patterns, such as investing in stocks, real estate or savings (Katona 1946; and more recently Earl et al. 2007).

The creation of financial pyramids and bubbles is primarily based on the inflow of money into a system established by its creators. In addition, the pyramid system also experiences money outflow due to some of the investors realising their profits. The money inflow and outflow, which cannot be infinite

due to the finite nature of money, dictate the functionality of the pyramids and the bubbles over time and, consequently, determine their lifetime. When, eventually, the outflow of money from the system is equal to, or surpasses, the inflow, the collapse of the pyramid or the bubble becomes imminent.

Significant psychological factors underlying the emergence of financial bubbles and financial pyramids include the social interaction between investors and signalling trust, particularly in new markets where knowledge about the new investment opportunities is limited or inaccessible to potential investors (Caginalp et al. 2001). Interactions between investors play a major role in influencing their behaviour, which in turn affects market dynamics and asset pricing. Investors learn from the behaviour of their peers, talk to each other, praise successful investments and inform each other about unsuccessful investments. Shiller (2000) indicated that the major interactions of investors are with friends and relatives, and these discussions are based on trust between close peers. This group behaviour of investors may affect personal contacts and interactions throughout the formation of a bubble and its ultimate collapse.

Investor behaviour can also be affected by imitation of close contacts and peers, mostly when other investors generate substantial profits from their investments. Imitation occurs when potential investors lack time or energy to evaluate assets for potential investment, but rather base their decision-making solely on trusted sources, such as successful relations and peers. These modes of cooperative herding are built on the notion that imitation leads to positive feedback (i.e. an action leads to consequences that reinforce the action and so on), and may result in either virtuous or vicious cycles (Zhou and Sornette 2008).

Social Interactions Between Agents, Decision-Rule Cascades and Trust

Signalling theory reflects scenarios of asymmetric information between agents. Spence's theory (1973) describes economic transactions that are characterised by inequalities in access to information, resulting in information asymmetries. One side (the seller) is totally informed and sends a signal about the value of a service or a product (e.g. the price), but the signal can be true, reflecting the correct value of the goods, or false, reflecting an inflated value (e.g. higher price). As the other side (the buyer) is not well-informed

about the true value of the goods, they may trust the signal received or reject it as false. Signalling theory suggests that the only signalling equilibrium occurs when the sender signals honestly the value of their goods and the receiver fully trusts that information as genuine. However, in many cases, profit-driven sellers are motivated to signal higher values to maximise their revenue.

Further, when senders are successful in signalling their trustworthiness, receivers have a higher willingness to cooperate with them and to complete the economic transactions. The overall high solidarity and reciprocity among participants in a society show that receivers cannot effectively distinguish between trustworthy or unreliable senders and vice versa. To resolve the above-mentioned market failure, economic agents share information through cooperation. This mechanism is so effective that even "selfish" individuals who solely follow their own interests will cooperate (Binzel and Fehr 2010).

Binzel and Fehr's (2010) analysis identified the determinants of trust at various social distances when information asymmetries are present. For example, the increase in trust follows the reduction in social distance, as trusting parties are more inclined to follow their beliefs when interacting with their close friends. However, when an interaction with an initially-unknown agent occurs, the decision to trust is driven mainly by social preferences. If differences in trust are caused by greater unconditional kindness towards others, external actors may confront difficulties in receiving trust from others (similar results concerning rural social capital leading to formation of trust in countryside villages and towns are found in Mikiewicz and Szafraniec 2010).

When many sellers flood the market with deceptive signals, a decision-rule cascade occurs and distracts the rational expectations of buyers from the real value of the goods. Precipitous price movements take place when decision-makers have similar expectations about rising prices and change relatively conservative investment strategies into riskier and less rational decisions. Such a process is inherently prone to fostering collectively irrational expectations about returns on investments, and ultimately results in a precipitous market correction (Katona 1946; Earl et al. 2007). As Earl et al. (2007) summarised, "People are attracted by systems that seem to make others wealthy, even though such people have merely been lucky temporarily to be able to achieve above-average returns". Thereupon, "the structure of investment is a function of the investment rules that agents have acquired

and the structure of these rules evolves whenever new rules are introduced and are subsequently adopted and retained. Sometimes this leads to wealth creation; sometimes it leads to bubbles" (*ibid.*).

Theories that explain price variability in the financial market can also be applied to the study of financial pyramids and speculative bubbles. For example, habitual patterns suggest that the propensity to invest is positively correlated with the consumption level, implying ongoing demand and price growth. Further, when the market is on the rise, hostility towards losses decreases, and this leads to greater acceptance of risk, to smaller expected return on investment, and to rising prices (Baker and Underhill 2015; Koschate-Fischer et al. 2018). However, beyond the economic and rational mechanisms that underlie the decisions of investors, the degree of self-esteem and optimism of the investors may greatly affect their judgment and their decision-making processes (Tang and Baker 2016; Angelini and Cavapozzi 2017). Former studies on the link between investors' optimism and investment decisions suggested that the trust levels of investors in the stock market (or in any other financial market) are very high when their optimism and self-esteem are high. Investors often believe that, despite decreasing asset prices, the market will inevitably recover and growth in asset prices will follow. This phenomenon can largely be explained by subjective experience and selective memorisation of events by investors, who usually remember positive periods of rising asset prices but are likely to neglect crises that were characterised by crashing prices (Shiller 2000; Sornette 2017).

Some investors are motivated by impulsive investment decisions, mostly when earlier investors signal or manifest their success through social interactions. Arbitrators predict the behaviour of impulsive investors and create an arbitrage that utilises the impact of impulsive investors in ways that further destabilise the market. When the arbitrators receive positive signals about the asset and its value, they anticipate that the initial price increase will stimulate less experienced, less knowledgeable impulsive investors to invest in it during the next periods (Lin et al. 2010; Hula et al. 2015). Following these expectations, informed rational investors increase their asset purchases and prices steeply rise even before the entry of impulsive investors, delivering to them increasingly stronger signals about the potential profitability of the asset (De Long et al. 1990).

Results

The case study hereinafter introduces the stages of the Hungarian earthworm pyramid that flourished in rural areas of the country. The economic and behavioural aspects are also presented and analysed.

The Case of the Hungarian Earthworm Pyramid

After 1968, with the introduction of the New Economic Mechanism (NEM) and through the 1970s, Hungary's economy experienced reforms under its centrally planned, state-managed economic regime. The reforms supported the development of small private businesses to fulfil the needs of the Hungarian economy and as a means of supplying goods to the local and national markets complementary to state-owned companies and organisations (Antal 1979; Bauer 1984; Csurgó et al. 2019).

The private sector of the Hungarian economy under the communist regime was largely characterised by small and temporary businesses that followed popular trends, mainly in the agricultural sector, for short-term profit generation due to the economic conditions and restrictions on citizens developing private ventures (Szelényi 1988; Danis and Shipilov 2002).

These hybrid public-private ventures formed the basis for the nation's relatively rapid transition from socialist, state-owned companies to private ventures by the end of the Soviet Communist regime, which had been present in Hungary since its occupation after the Second World War, and lasted until the late 1980s (Stark 1992; Kaufmann 2007).

This period was also characterised by a global effort to reclaim less fertile areas, such as deserts, for agricultural growing, led by Japan as well as other Western countries (see, for example, Nabhan 1984; Tohyama and Tohyama 1995). In parallel, at the end of the 1980s, European states became aware of the dangers and long-term environmental effects associated with synthetic fertilisers and motivated farms to replace them with bio-humus (Cannell and Hawes 1994; Schmidt et al. 2003; Holland 2004).

Research on the production of bio-humus by earthworms and its cultivation involved Hungarian agricultural research institutes due to the pivotal contribution of the agricultural sector to the Hungarian economy and

the private market development in Hungary. The national efforts were led by the Small Animal Breeding Institute in Gödöllő, one of the major agricultural research groups in Hungary, which studied the economic benefits of common earthworm proliferation. After bio-humus production by earthworms was tested and optimised for domestic soil and growing conditions and the results were published by the local press, several foreign and national experts argued that bio-humus production could financially benefit local farms, particularly when based on earthworms imported from Italy. Consequently, companies specialising in the propagation of earthworms became interested in their distribution to Hungarian farmers.

Erdélyi (1992) argued that companies offering purchases and investments in earthworm operations originated from Italian entrepreneurs, as earthworm farming ventures were popular in Italy during the 1980s; however, these companies were bankrupt by 1984. Hungarian businesses surrounding the growth, cultivation, and trade of earthworms were initiated in the late 1980s and ended at the beginning of the 1990s in a nationwide scandal, leaving more than 40,000 borrowers in debt.

The initial phase of the growth of the earthworm sector occurred shortly after the fall of the Communist regime in 1989 and the transition to a private market economy. Marketers of earthworms promised that money invested in earthworms could be tripled or quadrupled within a year without substantial effort by selling humus produced from animal excrement – the free by-product of any agricultural operation. Companies linked to the Small Animal Breeding Institute deployed agents in every Hungarian county and provided "oral guarantees" to purchase the humus produced from earthworms acquired from these farms or trading the humus on behalf of them. Other companies were formed to organise the process of funding initial investments in earthworms to initiate earthworm farming and humus production, presenting themselves as "integrators" that connect earthworm entrepreneurs to financing institutes.

The integrator companies essentially organised the marketing and facilitated transactions between sellers of the earthworms, buyers and financiers, including overseeing the preparation and the signing of contracts and loans. For their services, integrator companies charged a membership fee and commission per earthworm sale. For example, the Hungarian Horticultural Association charged membership fees of 9,500 forints for consultancy and representation, and 10% of the sale price. Banks including

OTP Bank (Hungary's largest bank), Agrobank, savings cooperatives, and other financial institutions provided funding to small entrepreneurs who could not raise the initial capital of 100,000 to 200,000 forints (approx. 1600 to 3200 USD). The loans provided to individuals were on a significantly larger scale than their disposable income, as the mean monthly net income in 1990 was 29,218 Forints (471 USD), with the poorest 20% earning 7,846 Forints (126 USD) on average (Szende and Culyer 2006).

As the volume of bank savings of households was relatively low during that period, due to the transition of the economic system "sharply curtailing their ability to save" (Denizer and Wolf 1998), loans for earthworm purchases were usually taken as short-term mortgages, which had to be secured by a guarantor. In 1989, consumer loans were provided to earthworm entrepreneurs but were renamed "ewes and cattle" loans at the beginning of 1990, allegedly due to OTP Bank's knowledge of their speculative nature (Erdélyi 1992). In 1989, OTP Bank approved only contracts in which integrators committed to buying the humus produced by the earthworms purchased. Jánosné Bodnár, the Deputy Managing Director of OTP Commercial Banking Directorate, reported that 10,000 customers borrowed 2 billion forints to fund their earthworm ventures between 1987 and 1989, and an additional 2 billion forints was borrowed from OTP Bank in the following years. It is estimated that similar amounts were provided in loans by other banks and financial institutes. Approximately 1 billion forints was defaulted and never paid back (Erdélyi 1992). In many cases, contracts and credit agreements did not meet the legal requirements. Contracts were often signed with blank, unpaid credit contract details, and the information was later sent by the staff of the creditor company. Guarantors signed for borrowers and vice versa, and employees of credit institutes and banks were earthworm sellers or brokers for integrator companies. For example, the head of the savings cooperative in the village of Adony provided loans to borrowers who bought earthworms only from her it (Erdélyi 1992).

Erdélyi (1992) argued that a high ranking official in the *Independent Smallholders Party* (Független Kisgazdapárt – FKGP) played a major role in the dissemination of earthworm businesses in Hungary and in initiating the development of standards for earthworm humus in 1989. These efforts were supported by the allocation of research funding from the Ministry of Agriculture that led to widespread publications by the Ministry about the profitability of the humus production and the utility of earthworm cultivation.

The media was flooded with news as the national and local newspapers published media content supplied by the Hungarian Media Office (MTI), generating a rapid and widespread national awareness of earthworm humus production and its financial benefits. The media coverage was supported by conferences organised by integrators, in which former researchers who became their consultants provided scientific background and reasoning to earthworm cultivation. Others participated in lectures organised for the wide population by these companies. Notably, "among the patrons and lecturers of the conferences were also the representatives of the Ministry of Agriculture and the Ministry of the Environment, and the lecturers of the Agricultural University of Gödöllő and Keszthely" (an interview with Ferenc Sáfián – Head of the Association for the Protection of Biologists' Interest in Székesfehérvár).

The major purchases of earthworms for cultivation and production of humus took place between 1989 and 1990, causing their prices to increase with the expectation of profit-making. However, over time, integrators refused to purchase humus or to market it for producers, as promised. From the mid-1990 onwards, integrator companies disappeared or dissolved at a rapid pace, leaving their clients unable to sell their humus or homegrown earthworms.

From 1990 onwards, studies published by Hungarian experts proved that the earthworms marketed in the country did not produce quality humus as expected and their products could not be exported. Although integrators and banks could have been well-informed about these findings, the offer and sale of loans for earthworm purchases persisted. By the mid-1990s, many borrowers had become bankrupt and were unable to pay back their loans or to sell earthworms and their products. Epaker, a company that promised to buy earthworms which were not in demand to produce oil from them using a patent purchased from the Biological Research Center of Szeged, required payments of 10,000 to 20,000 forints from earthworm owners to complete contracts that would assure the earthworm purchases. However, the company ceased to operate by the time of the buy-in date and the contract fees were never returned to its clients. The final blow to the earthworm trade came when most of the earthworms imported from Italy were found to be infected with animal tuberculosis. Hence, both the earthworms and their products were infected and could not be used under any circumstances.

Though the full scale of loans provided by financial institutions for earthworm entrepreneurs remains unknown, the number of growers who

partially or completely failed to repay their loans is estimated to be more than 50,000 people (Tejfalussy 1991). Associations of earthworm entrepreneurs and guarantors, such as the National Association of Biodiversity Representatives, were formed to demand compensation for their members and argued that "according to studies today, 90% of the various types of organic fertilizers produced in our country are contaminated. Accordingly, it is virtually impossible to exclude chemicals, antibiotics, and disinfectants, and for a market sensitive Western bio-culture to have bought the humus products in Hungary" (Erdélyi 1992).

Following the collapse and disappearance of earthworm and integrator companies, prosecution processes against their founders began. News coverage was mainly dedicated to the personal cases of victims affected by the scheme, the possibilities of compensation, and how the system surrounding the earthworm pyramid functioned. Personal stories of persons affected by the scheme mostly presented the shady nature of the business transactions of the parties involved. For example, one of the victims told the court how he met a representative of one of the integrator companies in a baby carriage storage to complete the purchase of earthworms (Petőfi Népe 1992, júl. 47: p. 154). However, due to slow legal proceedings, the parties responsible for the collapse disappeared before any losses were recovered. The earthworm pyramid also created social turmoil with parliament hearings and hunger strikes. Further, 18 suicide cases were attributed to the debts which earthworm entrepreneurs owed to their guarantors (Népszava 1992). Consequently, OTP Bank created a Bio-humus Fund containing 100,000,000 forints to support earthworm entrepreneurs after its responsibility for the crisis was acknowledged by the Court.

The motives underlying the engagement of the earthworm investors and growers can be attributed to various socio-economic aspects occurring throughout Hungary's transition period. Post-1989, the Hungarian regulation had to be modified to comply with the changes in the market. However, in several cases, the transition from central to market-orientated regulation did not fully address the risks of investors and the complete prevention of "bad loans". Hasan and Marton (2003) estimated the volume of non-performing credits provided to companies and individuals (later converted by the banks to state bonds by regulation) to be 15%-28% of the total loans. The terms of the existing regulatory structure, as well as the support from the Hungarian Ministry of Agriculture and the academic community, were used

by the organisers of earthworm enterprises and by the integrators for profit generation from customers lacking financial education and awareness.

During the economic transition of Hungary, and similar to other post-socialist countries, the economic inequality increased, hence resulting, on the one hand, in a broadening class of the *new rich* and, on the other hand, in a growing poverty among the lower classes of the population (Atkinson and Micklewright 1992; Gelencsér et al. 2012). To illustrate, between 1982 and 1993, Hungary's Gini coefficient measuring income dispersion and inequality increased by 6.9%, on a scale similar to that seen with other economies in transition, such as Poland, Russia and China (Ferreira 1999). The growing socio-economic differences between classes in the Hungarian society and the new opportunities for private entrepreneurship which opened up in the private market, created dynamics where the new rich functioned as a paragon of those who successfully embrace the new economic reality and the benefits of private enterprise. Consequently, the lower classes attempted to better their worsening living conditions by imitating the practices of private enterprises, despite their lack of know-how and skills. Additionally, the ease of associating new companies and the lack of sufficient legal compliance practices to protect investors made the distinction between legitimate and fraudulent business proposals extremely difficult for aspiring and inexperienced investors and entrepreneurs.

Szakonyi (2016) reviewed 25 cases of financial schemes in Hungary from 1991 to 2016 and identified typical features that are common to them, as follows:

- There was an acquaintance in the background who commanded the new business.
- Customers were charged "starting costs" or "initial investment costs" as a precondition for their participation in proposed ventures.
- Investors and customers were promised high returns on their investments: more than 20%, and often more than 100%, per annum, without elaboration of the risks associated with high returns.
- Use of luxurious cars and office locations, professional communication and strong signalling of luxury and success throughout the persuasion of customers and investors.
- Creating a sense of urgency to give the impression that customers who do not step in immediately will miss great opportunities for exceptional profits.

- Advertising in all media channels, including television, to present the legitimacy of ventures and to create trust.
- Political figures, parties or state institutes were directly or indirectly involved in almost every case, while in some cases their involvement was made public only after the collapse of the scheme.
- In every case, new post-scheme frauds were offered to con the victims of past schemes by claiming successful recovery of some of their investments. False guarantee contracts regarding the replacement of losses with money were compiled, while victims were required to pay extra amounts for these "services".

Discussion and Conclusions

The end of the 1980s was characterised by the transition of former Communist countries (including Hungary) from a socialist market – where the economy was dominated by state-managed, centralised planning – to a free market economy. This transition fostered the emergence of numerous kinds of entrepreneurship that were motivated to utilise and to capitalise on the new business opportunities open to them, while some new entrepreneurs sought fast and dramatic gains without consideration given to the embedded risks due to their lack of financial consciousness and know-how. This social, political and economic environment gave way to multiple cases of financial pyramids and Ponzi schemes in the former Communist countries, leading to financial bubbles in which the properties held by investors were priced well above their real financial value due to expectations that their prices would continuously increase and larger profits would be generated.

The emergence of the earthworm cultivation and farming industry in Hungary is largely associated with the national and global development of agricultural research on bio-humus production, i.e. the adoption of earthworm practices coincides with technological discoveries, as suggested by Schubert (1988). Nonetheless, the purchase of bio-humus-producing earthworms was substantially facilitated by the socio-economic conditions formed by the regime change in Hungary and the economic transition experienced by the nation during this period.

Profit-making expectations of agricultural households and farm owners cast a shadow over reason and risk, as the earthworm pyramid (reflected in

their purchase prices) was fuelled by the opening of the formerly socialist Hungarian market to the West, the gap between income levels of Hungary and the Western (i.e. "capitalist") nations that surround it, and the lack of financial and business knowledge and practice after decades of socialist dominance (similar aspects were also eminent in cases of other pyramids in Eastern European nations – see Bezemer 2001).

Table 1. Attributes of financial pyramids and Ponzi schemes and comparison to the earthworm pyramid

Attributes	Examples from other cases	Hungarian earthworm pyramid
Investment is uncorrelated with the real value of assets	Dutch tulips (Verdery 1996); Ponzi's investment stamps (Frankel, 2012); Albania's VEFA pyramid, among others (Jarvis, 2000)	Earthworms' value exceeded their real net value, due to expectations for a generation of high profits
Rapid increase in prices due to speculation	Dutch tulips (Verdery, 1996); Ponzi's stamps and more recently Madoff's investment securities (Frankel, 2012)	High and stable earthworm prices that depreciated after failure to sell the bio-humus
Institutional involvement	Albanians and Romanian officials involved in attracting customers to the schemes (Bezemer, 2001; Verdery, 1996). In contrast, the involvement of the Dutch government led to the collapse of the tulip pyramid (Verdery, 1996)	Hungarian Ministry of Agriculture, local community officials, OTP Bank, among others
Marketing channels obscure the real net value of assets	Massive media campaigns in Romania, Albania and Russia's pyramids (Gogozan, 2009)	Sales and marketing via integrator companies
Real potential for economic returns	None in the cases of Ponzi and Madoff (Frankel, 2012); potential gains from tulip bulb growth (Verdery, 1996)	Potential profits from bio-humus had production and quality measures been centrally coordinated and enforced

The case study assists in identifying some of the characteristics of potential pyramids (see summary of the findings in Table 1). First, the required investments in production resources (such as the bio-humus-producing earthworms) became uncorrelated with the real value of these resources or with the future profits expected from them. Second, the rapid increase in earthworm prices converted them from a profit-generating

resource into a speculative and tradeable financial asset, whose trading produced significantly higher returns than the expected returns from its product. Third, the volume of investments in earthworms and the rapid increase in their prices were largely facilitated by vocal promoters who ignited expectations of rapid and large profits that could be made by investing in earthworms, beyond any economic reason. These promoters (mainly working for integrator companies) concealed both the real value and revenue that could have been generated by such investments. Fourth, despite committing to purchase the bio-humus from farmers, integrator companies did not present any tangible evidence of relations with potential buyers of the product, nor did they provide any description of existing purchase and sale channels and supply chains.

Our findings also indicate active involvement of the Hungarian Ministry of Agriculture, local community leaders, academics specialising in earthworm cultivation, and financial institutes (see Katona-Kovács et al. 2011 for analysis of rural community leadership in Hungary). Earthworm purchases were mostly promoted by integrators that linked the buyers to institutional finance providers. Integrators benefitted from commission payments and were the most vocal proponents of earthworm cultivation. Nonetheless, the profits of these companies paled in comparison to the financial gains of the loan-providing institutes, OTP Bank in particular. Estimations of the volume of loans and loan payments suggest that the fund established by OTP Bank as part of the aftermath of the asset bubble burst is nothing compared to the profits generated by loan-takers.

Interestingly, our findings indicate that the earthworm pyramid could eventually have turned into a productive and profitable agricultural business due to the demand for these products in Western Europe. This venture could have been successful had the imported earthworms been inspected and had the authorities enforced standards of quality for the bio-humus production process that were informed by scientific research in Hungary and in other countries. It was the transition from a centrally-operated economy and agricultural marketplace, initially managed and controlled by a single administration, to a decentralised market structure that led to coordination problems and consequently yielded non-standardised products, rendering them useless.

The Hungarian earthworm pyramid has remained less well-known than other financial bubbles and pyramids that occurred during the same period,

such as the Albanian pyramid; this may be due to the relatively limited impact of the bubble burst on the Hungarian economy as a whole. Nonetheless, the Hungarian earthworm pyramid highlights various lessons and points of interest referring to economies in transition and to the introduction of new inventions to these markets (in this case, new agricultural practices). First, the earthworm pyramid is rather unique, as it possesses elements of a sectoral or topical pyramid surrounding agricultural cultivation and production; most pyramids are financial, offering some form of financial investment in stocks and bonds. Second, although the earthworm pyramid could be considered a pyramid or a bubble due to the inflated valuation of its main asset (the earthworm), the innovation at the basis of its narrative, by which financial gains could be produced from bio-humus sales, is supported by a large body of academic research and literature. Thereupon, under other circumstances, bio-humus production coupled with the agricultural knowledge and experience developed in Hungary for centuries could potentially become a profitable venture. Third, the decentralisation of the Hungarian economy during its transition period eventually led to lack of coordination among earthworm farmers and bio-humus producers, hence resulting in a low-quality and inconsistent product that could not be marketed or used by growers abroad. A centralised organisation of the marketing and standardisation of the production process of bio-humus (as was imminent under the former regime) could have probably supported the development of this sector, providing tangible income to earthworm cultivators.

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