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# Do capitalistic institutions breed billionaires?

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**Abstract** There is a new wave of interest in the inequality of income and wealth in the social sciences as well as in physics. On the top of the list are persons who own assets of US dollar 1 billion and more. Not much is known quantitatively of the distribution of these persons among countries. In this paper, it is analyzed empirically whether more capitalistic countries, as measured by index variables of economic freedom, exhibit a systematically larger number of billionaires in the year 2012 than less capitalistic countries. The main result is that the typical economic freedom indicators do not play a statistically significant role with respect to the number and wealth of billionaires, except the protection of property rights. In addition to that, according to further empirical results of the paper, billionaires may not be economically harmful for the respective countries as their existence, number and wealth is positively correlated with the GDP per head.

**Keywords** Billionaires · Capitalism · Economic freedom · Property rights

**JEL Classification** I31 · O57 · P14 · P17

> Accumulate, accumulate! That is Moses and the Prophets!
> Karl Marx (1999 [1867]), Ch. 24, Section 3, p. 652.

> The distribution of wealth is more unequal than the distribution of income, and very high incomes will eventually pupate into very large fortunes, ultimately leading

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to a hereditary dystopia of idle rich.
Angus Deaton (2014), 783.

## 1 Introduction

The inequality of income and wealth is back on the agenda of economics and the social sciences (see, e.g., Piketty 2014; Science 2014; Haseler 2005). In the aftermath of the financial meltdown of the years 2008 and later, the money games played by banks, hedge funds and other wealthy institutions and persons was a kind of wake-up call to the fact that income and wealth are very unequally distributed among households and nations (for the world distribution of wealth see Davies et al. 2011). Moreover, the number and wealth of so-called "mega-rich" (Haseler 2005, p. 243) is still increasing world-wide, despite the crises of 2008. Another empirical phenomenon is the increase in inequality—and in particular the number of billionaires—in emerging countries (Petras 2008); as it seems, this development is in contradiction to the so-called Kuznets-curve (Hvistendahl 2014).

However, although even the names of the "mega-rich" are well-known, not so much is known on the relationship between the number and wealth of billionaires and the countries in which they live and where they earned (or inherited) their wealth. Although one may expect that billionaires are cosmopolitans, they seem to be rather rooted to their soil of origin; for instance, only 15 % of the "self-made billionaires" emigrated (Sanandaji 2013, p. 329). Hence, it may make sense to look for characteristics of their home-country to find the respective relationships. Of particular interest is whether there really exists a "patrimonial capitalism", as suggested recently by Thomas Piketty: "The general evolution is clear: bubbles aside, what we are witnessing is a strong comeback of private capital in the rich countries since 1970, or, to put it another way, the emergence of a new patrimonial capitalism" (Piketty 2014, p. 173). In this paper, it is tested empirically whether "(patrimonial) capitalism" is the source of the wealth of the mega-rich. Thereby "capitalism" is measured by components of the Index of Economic Freedom, as developed for and reported by the Heritage Foundation.

In the following, it is analyzed empirically in a cross-section of 178 countries for the year 2012, whether "capitalism", represented by its institutions, is a crucial determinant of whether there are mega-rich persons at all and the number of billionaires (their wealth is measured in US dollar, USD) in these countries. In a second step, the research question is whether or not "capitalism" and the number of billionaires can be considered as important correlates to the GDP per capita.

The paper is structured as follows. Firstly, the relevant literature is reviewed. Secondly, the empirical approach and the data are presented. Thirdly, the empirical results are shown and discussed. The last section concludes.

## 2 Literature review

Super-rich and mega-rich persons seem to be of public interest since ancient times. From an economics viewpoint, the research question is whether there are determinants of the number of mega-rich persons in a country that have a generic economic meaning.

At first glance, it might seem that pure luck plays the dominant role in the process to become extremely rich: either it is the economic success of a great idea or it is the luck to be born into an already very rich family. The data tell us, however, that it is not so much inheritance what makes people mega-rich, but economic success. According to the web pages of wealthx.com, two-thirds of billionaires as well as billionaires' wealth are self-made, with additionally 16 % that are inherited as well as self-made. Consequently, self-made billionaires play a dominant role among billionaires. However, this was not the general picture in the past. About up to World War II, inheritance was the major source of very high wealth in the USA, Australia and Great Britain; thereafter, self-made fortunes dominate by far (Siegfried and Round 1994, Table 1, p. 195). Hence, "… Schumpeter's description of the capitalist 'hotel', always full but with the guests always changing" (Atkinson 1975, p. 152) seems to be a plausible description of the accumulation of very large fortunes.

Theoretically, it is not as surprising as it may seem that a small number of people can become so rich. Applying stochastic tools to this question demonstrates that there will be only a very small number of all-time winners as well as all-time losers in economic contests; consequently, the temporal development of the concentration of wealth can be formalized as a stochastic process in which the share of people at the bottom and at the top of the wealth distribution will be rather small (Steindl 1965; Brown 1976; for so-called econophysics analyses see, e.g., Cho 2014; Chakrabarti et al. 2013). Moreover, similar stochastic processes can be found in the size distribution of firms, as firstly described by Gibrat (1931; see also Steindl 1965), and in the distribution of city sizes (Zipf 1949; Gabaix 1999). The result for wealth (and income) is that for a large majority of the population wealth follows an exponential distribution; only for a very small part of people it is characterized by a power-law (or Pareto) distribution (see Yakovenko and Rosser 2009) whereby the latter arises from a multiplicative stochastic process. However, purely stochastic models describe accumulation processes, without an explanation of their economic rationale [see for the economic content of such stochastic models (Shorrocks 1976, pp. 636 f.)].

The economics literature on billionaires can be separated into three groups: the first group of papers studies the statistical distribution of the super rich's wealth, the second group contains country studies concerning the question how the super rich did get their fortunes, and the third paper group focuses on the institutional determinants of the number of billionaires in different countries.

Studies of the statistical wealth distribution among the super rich in the USA, employing the Forbes 400 lists of the richest persons (Levy and Solomon 1997; Klass et al. 2006, 2007), as well as Drăgulescu and Yakovenko (2001), find evidence for a Pareto power-law tail in this part of the wealth distribution (see Persky 1992, for the history of Pareto's law of income distribution). Drăgulescu and Yakovenko (2001) report also a Pareto tail for the UK and Ogwang (2011) provides some evidence for Canada (however, as Ogwang demonstrates, the results depend on the estimation method). Also for very different countries with respect to culture and economic development such as India (Sinha 2006; Jayadev 2008) and China (Ding and Wang 2007), the same kind of power-law tail seemingly describes the top wealth distribution there. In contrast, for the world distribution of top wealth for each year from 2000 to 2009, employing data of Forbes, no evidence of a Pareto tail could be detected (Ogwang

2013). With the same data source, Brzezinski (2013) concludes that with data for the richest people in America (1988–2012), China (2006–2012), Russia (2004–2011) and the richest persons of the world (1996–2012), a power-law distribution is compatible with the data in 35 % of the datasets (Brzezinski 2013). Nevertheless, even if the empirical distribution of the richest persons of the world may differ from a Pareto power-law tail, it is hardly deniable that wealth is heavily concentrated at the top of the wealth pyramid since the richest 10 % persons own 71 % of global wealth, with a GINI inequality index value of 0.802 (Davies et al. 2011).

A statistical explanation of the presumable Pareto power-law tail of the top wealth distribution is given by Reed (2001). A "double Pareto distribution", as he calls it, results from "… a GBM [geometric Brownian motion, A. P.] observed after an exponentially distributed time $T$" (Reed 2001, p. 16). Hence, if instead of using a fixed time $T$ for calculating the distribution that results from a GBM, the time $T$ of observation itself is considered as an exponentially distributed random variable, Pareto power tails emerge at the top and at the bottom of the distribution of income and wealth too (Reed 2001, p. 18 and p. 16).

An important result of the analysis on the determinants of the reasons why some people could get so rich in their respective home countries is that this changed about the year 1940. In former times, large fortunes had predominantly been inherited; afterward, they are mostly self-made (see Table 1 in Siegfried and Round 1994, p. 195, with data for Australia, the UK and the USA). This must be considered a tremendous change since self-made fortunes are earned by very successful investments in contrast to inherited fortunes which had been earned by people in earlier periods.

However, even if the most mega-rich people became so rich because of successful economic activities, it is not clear whether it is talent or luck that brought about success. An empirical investigation of high-income investors in the USA found that stocks of these investors grow much faster than those of investors with lower incomes (Yitzhaki 1987). The reason seems to be that high-income investors prefer riskier stocks, in comparison with investors with less income (Yitzhaki 1987). In contrast, by modeling a stochastic process of wealth accumulation, Levy (2003) reports that only homogeneously distributed investment talent implies theoretically a Pareto distribution of wealth. Moreover, in an investment experiment, Levy and Levy (2003) found that luck rather than investment talent can explain the Pareto distribution of wealth.

At least in earlier studies of the mega-rich in the USA (Blitz and Siegfried 1992), the UK (Siegfried and Roberts 1991), Australia (Siegfried and Round 1994) and New Zealand (Hazledine and Siegfried 1997), it was found that two-thirds of the fortunes came from competitive industries and not from monopolies. As explanations for the phenomenal success of the super-rich self-made people in the above mentioned studies, the following sources are suggested: the ownership of scarce resources, infra-marginal rents, disequilibrium profits, innovations, product differentiation, risk-taking and extraordinary entrepreneurial and managerial skills, as well as luck.

In contrast, about half of Indian billionaires, owing 60 % of Indian wealth, earned about half of their fortunes from so-called "rent-thick" sectors as real estate, construction, infrastructure, media, cement and mining (Ghandi and Walton 2012). Moreover, according to Petras (2008), billionaires in Russia, Latin America, China and India

did get rich by acquiring state-owned assets, in the wake of privatization of formerly public enterprises, and in military coups (Latin America) (Petras 2008, p. 327).

Investigating the institutional determinants of billionaires, in contrast to self-employed persons, Sanandaji and Leeson (2013) conclude on the basis of correlations that the protection of private property rights and market-enhancing institutions are crucial determinants of the number of billionaires in respective countries, whereas in countries with a lack of well-protected property rights and market-enhancing institutions self-employment, but not a high number of billionaires, prevails. Employing regression analysis, Neumayer (2004) reports that only the level of property rights protection contributes in a statistically significant way to the explanation of the number of the billionaires in the Forbes list, world-wide averaged over the years 2001–2003; variables of government intervention and control, the fiscal burden, trade openness and the level of social protection played no statistically significant role when controlling for GDP per capita, population size and the (extraordinarily high) number of billionaires in the USA.

In this paper, it is investigated with data from the Forbes list of billionaires 2012 whether "capitalism", as measured by the respective indicators of the Economic Freedom Index, EFI, of the Heritage Foundation, plays a billionaire-increasing or billionaire-decreasing role. In effect, the very different positions of Petras (2008) on the one hand and of Neumayer (2004), as well as of Sanandaji and Leeson (2013), on the other hand will be tested: Does "capitalism" play any role in determining the number of billionaires globally?

## 3 Approach and data

Although the dynamic economic process that leads to extremely skewed distributions of wealth (and other economic and non-economic variables) might be a more or less random one, there may also be genuinely economic factors at work, especially with respect to the existence and functionality of the mega-rich. The economic hypothesis for the empirical investigation in this paper is that capitalistic institutions, as quantified by the indicators of *economic freedom*, create a social environment in which the economy and, hence, the accumulation of success, capital and wealth prospers, as suggested by Sanandaji and Leeson (2013), in contrast to Petras (2008) who claims that the level of bondage rather than freedom determines the number of billionaires and their wealth.

To test this hypothesis, a so-called "two-part Hurdle model", more exactly, a "negative binomial-logit Hurdle regression" (Hilbe 2014, pp. 184 ff.), NBL-regression, is applied.[1] This is required since 55 out of 178 countries for which data are available do not have any billionaires (in US dollars). In the NBL-regression approach, two estimations are combined, i.e., Eq. (1) is estimated in two parts. In the first part, it is estimated whether or not capitalistic institutions decrease the probability that there are no billionaires in a country. Accordingly, all countries in the dataset are classified as

[1] Note that a negative binomial count estimation is chosen because the data on the number of billionaires show overdispersion (i.e., the mean number of billionaires is greater than the variable's expected variance).

either having (at least one) US dollar-billionaire (value = 1) or having no billionaire (value = 0):

$$\begin{aligned}\text{Bill2012(yes} = 1) = \beta_0 + \beta_1 \cdot \text{BF} + \beta_2 \cdot \text{FF} + \beta_3 \cdot \text{IF} + \beta_4 \cdot \text{LF} + \beta_5 \cdot \text{MF} \\ + \beta_6 \cdot \text{TF} + \beta_7 \cdot \log(\text{Pop2012}) + \varepsilon, \end{aligned} \quad (1)$$

with BF business freedom, FF fiscal freedom, IF investment freedom, LF labor freedom, MF monetary freedom, TF trade freedom and log(Pop2012) as the natural logarithm of population size in 2012.

Since the dependent variable is a binary one, a binary logit model is estimated in this part.

In the second part of the estimation, a zero-truncated negative binomial count data model (Hilbe 2014) is estimated, with the number of billionaires 2012 in the sample countries as the dependent variable in Eq. (1), instead of the binary variable Bill2012. Note that in this estimation the truncation of the data at zero is econometrically accounted for.

Equation (1) contains the explanatory variables that are employed to test whether capitalistic institutions, as measured by the 'freedoms' of the Economic Freedom Index, are important factors for economically very successful individuals such as billionaires. Additionally, the size of the population may be a crucial determinant for the number of billionaires; it is, therefore, included in Eq. (1).

Next, a number of additional variables are included. The estimation method is the same as with Eq. (1), i.e., a NBL-regression. The additional independent variables for the respective countries, besides the components of the Economic Freedom Index, are: GDP per capita and population size 2012, Human Development Index (non-income variables), the guarantee of property rights[2], the rate of unemployment, the burden of taxes in percent of GDP, the public debt in percent of GDP, the income tax rate, the corporate income tax rate, as well as the average GDP growth rate between 2002 and 2011. Hence, in this estimation the respective variables for measuring 'capitalism' as economic freedom are included; moreover, the presumably special role of property rights (Neumayer 2004) is accounted for by an explicit inclusion of this variable.

The first group of the additional variables contains factors that are considered as to be negatively correlated with the number of billionaires in a country. These variables are the rate of unemployment, the tax burden in percent of GDP, the public debt in percent of GDP, as well as the income tax rates and the taxes rates on corporate income.

With a second group of variables, it is attempted to control for the heterogeneity among countries. These variables are the GDP per capita and the population size as well as the Human Development Index, HDI (without the income components, since this element is accounted for by the GDP per capita). Moreover, since wealth as a

[2] Note that also 'freedom of corruption' is a variable in the Index of Economic Freedom; however, a correlation analysis revealed that the correlation between this variable and 'protection of property rights' is larger than 0.9. Therefore, 'freedom of corruption' is not included here because 'protection of property rights' produces better econometric results.

stock variable is accumulated over time, the average GDP per capita growth rate of the ten years preceding the year 2012 (i.e., 2002–2011) is also incorporated.[3]

In order to check further the reliability of the empirical results, the estimation equation is changed in such a way that the logarithm of the GDP per capita is taken as the dependent variable. The estimation equation reads then:

$$\begin{aligned}\log(\text{GDPpc2012}) = {} & \beta_0 + \beta_1 \cdot \text{Bill2012}(\text{yes} = 1)[\text{NoBill2012; BillWealth}] \\ & + \beta_2 \cdot \text{EcF} + \beta_3 \cdot \text{PropRights} + \beta_4 \cdot \text{UnempRate} \\ & + \beta_5 \cdot \text{TaxBurden} + \beta_6 \cdot \text{ITR} + \beta_7 \cdot \text{CTR} \\ & + \beta_8 \cdot \log(\text{Pop2012}) + \beta_9 \cdot \text{HDI\_NI} \; (+\beta_{10} \cdot \text{USA}) + \varepsilon \quad (2)\end{aligned}$$

with BillWealth as the wealth of the billionaires in US dollar, EcF Economic Freedom Index, PropRights property rights, UnempRate unemployment rate, TaxBurden taxes in percent of GDP, ITR income tax rate, CTR corporate income tax rate and HDI_NI the Human Development Index without income components.

The advantage of estimating Eq. (2) in comparison with Eq. (1) is that the GDP per capita is larger than zero for all countries; therefore, OLS estimations are sufficient. In this way it can be checked whether the estimation method makes a difference here. Note that three versions of Eq. (2) are estimated. In the first version, the binary variable that indicates whether there are billionaires or not is applied; in the second version, the number of billionaires is used and in the third, the billionaires' wealth in US dollars is incorporated.

The data employed to estimate the respective equations are taken from a small number of sources. The number of billionaires and the billionaires' wealth in the year 2012 is taken from Forbes magazine, as provided by http://stats.areppim.com/listes/list_billionairesx12xwor.htm [accessed May 30, 2014]. The indices that are aggregated into the Index of Economic Freedom are taken from the Heritage Foundation that publishes these data on a regular basis in collaboration with The Wall Street Journal since 1995 (see the homepage of the Heritage Foundation at www.heritage.org/index). The data of the Human Development Index (HDI, developed by the UNDP), as well as the data of the GDP per capita, the growth rates of GDP per capita, as well as the population sizes, are imported from the World Bank data warehouse. The data on property rights, the tax burden and tax rates are from the economic freedom dataset.

An additional remark concerning data comparability is necessary. It is supposed that the quality of data is more or less the same across countries. Moreover, since data for number of billionaires were taken for the year 2012, respective country-specific data were collected for the year 2012, too, as far as possible. For this reason, values of the Economic Freedom Index are taken from the data published in 2014 as the data for this index seem to be collected around the year under consideration here. Moreover, to represent the fact that wealth is accumulated over time, the average growth rate

[3] Moreover, the average rate of gross capital formation (i.e., gross investments) was also intended to be applied as a variable. However, the data on this rate contain many missing values, not only for single years, but also for several years in a row and for several countries. Therefore, it could not be used here.

of the GDP per capita for the years 2002–2011 is applied.[4] Unfortunately, it was not possible to employ data on gross capital formation (gross investments), because the data contain too many missing values for various countries and years.

## 4 Data analysis and results

### 4.1 Number of billionaires

As indicated above, there is an econometric problem with the estimation of the full dataset of 178 countries as there are no billionaires in a larger number of these countries.[5] Consequently, the dependent variable, the number of billionaires, is censored. To solve this problem, Neumayer (2004) applied a maximum likelihood Tobit estimation. In this paper, a negative binomial logit-regression is run (Hilbe 2014). In the binary logit estimation, the interpretation of a significant positive sign of an independent variable is that it decreases the odds that there is no billionaire (Hilbe 2014, p. 188); in the negative binomial count estimation, an independent variable's significant positive coefficient means that the variable increases the number of billionaires (Hilbe 2014, p. 188).

The results of Table 1 indicate that only two of the six indicators of economic freedom (note that financial freedom was not included because of a too high correlation with investment freedom) have a statistically significant effect that decreases the odds that a country in the sample has no billionaire: business freedom (at the 1 % level) and trade freedom (at the 10 % level). The population size variable (ignoring the estimation constant) has by far the strongest impact in this respect. In the second column of Table 1, the results of the zero-truncated negative binomial estimation are shown. According to this estimation, only higher levels of business freedom are positively correlated with a higher number of billionaires (at an error level of 5.1 %). Again, the log of population sizes has the strongest effect. Hence, it can be concluded that, first of all, business freedom may be the most crucial capitalistic determinant of the existence and number of billionaires in the sample of countries considered here.

To check this, a number of other variables are included as additional determinants, as well as controls for the heterogeneity of countries. The estimation results are presented in Table 2.

The estimation results presented in Table 2, first column of estimation coefficients, show that all 'freedom'-variables are now statistically insignificant.[6] Besides the estimation constant, the logarithm of GDP per capita and of population size are statistically significant. This implies that Business and Trade Freedom do not decrease the odds of

[4] Data for all ten years are not available for all 142 countries included in the estimations. The respective average growth rate is calculated by dividing the sum of the growth rates by the number of years for which data are available.

[5] Due to missing data, only 142 of these 178 countries could be included in the estimations.

[6] Replacing the 'freedoms' in Table 2 by the Economic Freedom Index yields (estimation not presented here) that a higher EFI significantly (at the 5 % level) decreases the odds for having no billionaire, but that it is insignificant (error level 10.5 %) with a much smaller coefficient concerning the number of billionaires.

**Table 1** Capitalism and billionaires in a large sample of countries, 2012: freedom indicators

| Independent variables | Coefficients of estimation (error probability) binary logit | Coefficients of estimation (error probability) negative binomial count |
|---|---|---|
| $\beta_0$ (constant) | −34.1557*** | −15.5113*** |
| | (0.000) | (0.000) |
| Business freedom | 0.0734*** | 0.0251* |
| | (0.002) | (0.051) |
| Fiscal freedom | −0.0381 | 0.0070 |
| | (0.132) | (0.550) |
| Investment freedom | −0.0056 | 0.0027 |
| | (0.745) | (0.795) |
| Labor freedom | 0.0228 | 0.0114 |
| | (0.212) | (0.222) |
| Monetary freedom | 0.0718 | −0.0278 |
| | (0.133) | (0.367) |
| Trade freedom | 0.0655* | 0.0379 |
| | (0.086) | (0.179) |
| Log(population 2012) | 1.2225*** | 0.7891*** |
| | (0.000) | (0.000) |
| Akaike info criterion | 2.820 | |
| Total obs. | 173 | |

Negative binomial-logit Hurdle regression dependent variable: binary logit estimation: number of billionaires = 0 or >0(= 1)
Negative binomial count estimation: number of billionaires 2012 (if >0)
***, **, * Statistically significant at the 1, 5 and 10 % error level, respectively

having no billionaires in a sample country. However, also all control variables, except the log values of GDP per capita and population size, are statistically insignificant.

Almost the same holds true for the negative binomial estimation of the impact of the variables on the number of billionaires. However, the difference is that Property Rights have here a positive and statistically weak impact, besides the strong impact of the logs of GDP per capita and population sizes. This result is in accordance with that of Neumayer (2004).[7]

### 4.2 GDP per capita estimations

In this section, the research question is reversed. Instead of asking how the number of billionaires correlates with capitalistic institutions, GDP per head is now the dependent variable. The regressors are again capitalistic institutions and the respective control

[7] Although the USA with 425 billionaires in 2012 may be considered as an outlier in this dataset, re-estimating Eq. (1) without the USA did not change the qualitative (statistical and economic) results presented here.

**Table 2** Capitalism and billionaires in a large sample of countries, 2012: all variables

| Independent variables | Coefficients of estimation (error probability) binary logit | Coefficients of estimation (error probability) negative binomial count |
|---|---|---|
| $\beta_0$ (constant) | −140.0781*** | −26.7334*** |
| | (0.011) | (0.000) |
| Business freedom | 0.0081 | 0.0030 |
| | (0.915) | (0.796) |
| Fiscal freedom | 0.3114 | 0.0413 |
| | (0.285) | (0.247) |
| Investment freedom | 0.0229 | −0.0044 |
| | (0.568) | (0.665) |
| Labor freedom | 0.0788 | −0.0005 |
| | (0.134) | (0.957) |
| Monetary freedom | 0.1891 | −0.0254 |
| | (0.129) | (0.257) |
| Trade freedom | −0.0340 | 0.0128 |
| | (0.693) | (0.615) |
| Property rights | −0.0792 | 0.0166* |
| | (0.222) | (0.094) |
| Unemployment rate | −0.0378 | −0.0027 |
| | (0.704) | (0.898) |
| Tax burden (% of GDP) | 0.2071 | 0.0148 |
| | (0.217) | (0.521) |
| Public debt (% of GDP) | 0.0206 | −0.0033 |
| | (0.304) | (0.314) |
| Income tax rate | 0.2012 | .01022 |
| | (0.194) | (0.685) |
| Corporate tax rate | 0.0754 | 0.0001 |
| | (0.571) | (0.998) |
| Log(GDP per capita 2012) | 4.5321*** | 0.7107*** |
| | (0.013) | (0.004) |
| Log(population 2012) | 3.2786*** | 0.9777*** |
| | (0.000) | (0.000) |
| Human Development Index (non-income) 2012 | −6.8404 | 1.7941 |
| | (0.532) | (0.411) |
| Avg. GDP growth rate | −0.3397 | 0.0542 |
| | (0.286) | (0.402) |
| Akaike info criterion | 2.818 | |
| Total obs. | 142 | |

Negative binomial-logit Hurdle regression dependent variable: binary logit estimation: number of billionaires = 0 or = 1. Negative binomial count estimation: number of billionaires 2012 (if >0). Huber/White standard errors and covariance

***, **, * Statistically significant at the 1, 5 and 10 % error level, respectively

variables; additionally, the existence of billionaires in a country, the number of billionaires and the billionaires' wealth are applied successively as variables. Moreover, a dummy variable for the USA is also included. The intention is to find out whether the correlation between the billionaire variables and GDP per capita remains robust.

In Table 3, the results of the estimation of Eq. (2) are reported. First of all, in the three versions of the estimations, the existence of billionaire, their numbers, and their wealth have a statistically significant positive correlation with GDP per capita, with the strongest correlation for the existence of billionaires in a country. Except monetary freedom in the first version of the estimation, no 'freedom' variable is statistically

**Table 3** GDP per capita and the number of billionaires in a large sample of countries, 2012

| Independent variables | Coefficients of estimation (error probability) | | |
|---|---|---|---|
| $\beta_0$ (constant) | 8.0003*** | 6.1924*** | 6.1467*** |
| | (0.0000) | (0.000) | (0.0000) |
| Billionaire(s): yes/no | 0.7407*** | | |
| | (0.0002) | | |
| No. of billionaires | | 0.0097** | |
| | | (0.0200) | |
| Billionaire wealth | | | 0.0025** |
| | | | (0.0478) |
| Business freedom | −0.0051 | −0.0050 | −0.0054 |
| | (0.3397) | (0.3920) | (0.3555) |
| Financial freedom | −0.0017 | −0.0002 | −0.0004 |
| | (0.7486) | (0.9733) | (0.9472) |
| Labor freedom | −0.0020 | −0.0008 | −0.0004 |
| | (0.6172) | (0.8484) | (0.9325) |
| Monetary freedom | −0.0145* | −0.0117 | −0.0113 |
| | (0.0856) | (0.1989) | (0.2150) |
| Trade freedom | 0.0060 | 0.0056 | 0.0054 |
| | (0.2841) | (0.3398) | (0.3550) |
| Property rights | 0.0205*** | 0.0227*** | 0.0225*** |
| | (0.0003) | (0.0001) | (0.0002) |
| Unemployment rate | −0.0008 | −0.0005 | −0.0009 |
| | (0.8594) | (0.9116) | (0.8469) |
| Tax burden (% of GDP) | −0.0219** | −0.0227** | −0.0225** |
| | (0.0140) | (0.0167) | (0.0177) |
| Public debt (% of GDP) | −0.0029 | −0.0026 | −0.0026 |
| | (0.1653) | (0.1919) | (0.1980) |
| Income tax rate | 0.0097 | 0.0120* | 0.0128* |
| | (0.1335) | (0.0741) | (0.0631) |
| Corporate tax rate | −0.0078 | −0.0075 | −0.0086 |
| | (0.3253) | (0.3572) | (0.2862) |

**Table 3** continued

| Independent variables | Coefficients of estimation (error probability) | | |
|---|---|---|---|
| Log(population) | −0.1571*** | −0.0875 | −0.0834 |
| | (0.0084) | (0.1072) | (0.1214) |
| Human Development Index (non-income) | 5.2038*** | 5.7638*** | 5.7582*** |
| | (0.0000) | (0.0000) | (0.0000) |
| Country dummy USA | 0.6501** | −3.5127** | −3.4652* |
| | (0.0262) | (0.0308) | (0.0695) |
| No. of observations | 142 | 142 | 142 |
| Adjusted $R^2$ | 0.7862 | 0.7616 | 0.7604 |
| $F$-statistic | 35.5615*** | 31.0324*** | 30.8385*** |
| | (0.0000) | (0.0000) | (0.0000) |

Dependent variable: GDP per capita, 2012. White heteroskedasticity-consistent standard errors and covariance

***, **, * Statistically significant at the 1, 5 and 10 % error level, respectively

significant. However, property rights are in all versions highly statistically significantly and positively correlated with the GDP per head. Moreover, the tax burden as percent of GDP is in all versions significantly negatively correlated with the GDP per capita, while the income tax rate has a (weakly) significant positive correlation with the dependent variable in two of the versions. The (non-income) HDI has the strongest significant positive correlation with the GDP per capita.

These results may be interpreted as follows. The positive correlation of the existence, the number and the wealth of billionaires might imply that it is not dangerous for the economy if there are very rich individuals. Particularly, it might be said that the existence of billionaires is more likely, the higher a country's GDP per head. However, capitalism (represented by its 'freedoms') as well as the lack of it, seems not to be of importance here, given that property rights are guaranteed. A further result worth mentioning is the negative correlation of the tax burden and GDP per capita, in contrast to the positive correlation between the income tax rate and GDP per capita. As it seems, higher tax rates of the income tax may not be as dangerous as politically propagated.

## 5 Conclusion

In this paper, the relevance of capitalistic institutions for the existence of billionaires in the world's countries is studied empirically. With Forbes data for the year 2012 on the number of billionaires and data on GDP per capita, the population, the non-income Human Development Index and variables of the Index of Economic Freedom (the latter variables are interpreted here as indicators of capitalism and capitalistic institutions), the determinants of the number of billionaires are investigated.

The results of the estimations with the number of billionaires as dependent variable show that capitalistic institutions and capitalism are seemingly unrelated to each other. This means that neither capitalism nor the lack of capitalistic 'freedom'-institutions are crucial for the global number of billionaires, as well as for the number of billionaires in those countries where there are billionaires. Of particular interest is that the protection of property rights is the only variable that plays a statistically significant role.

As a kind of robustness check, the estimations are repeated with the GDP per capita as the dependent variable. In these estimations, the existence of billionaires, their numbers, as well as their wealth are positively and statistically significantly correlated with the GDP per head. Hence, it may be concluded that the existence, the number and the wealth of billionaires seem not to be economically harmful for the respective countries.

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## References

Atkinson AB (1975) The economics of inequality. Oxford University Press, Oxford

Blitz RC, Siegfried JJ (1992) How did the wealthiest Americans get so rich? Q Rev Econ Finance 32:5–26

Brown JAC (1976) The mathematical and statistical theory of income distribution. In: Atkinson AB (ed) The personal distribution of incomes. George Allen & Unwin, London, pp 72–88

Brzezinski M (2013) Do wealth distributions follow power laws? Evidence from "rich lists". arXiv:1304.021v1 [q-fin.ST] 31 Mar 2013

Chakrabarti BK, Chakraborti A, Chakravarty SR, Chatterjee A (2013) Econophysics of income and wealth distributions. Cambridge University Press, Cambridge

Cho A (2014) Physicists say it's simple. Science 344(6186):828

Davies JB, Sandström S, Shorrocks A, Wolff EN (2011) The level and distribution of global household wealth. Econ J 121(551):223–254

Deaton A (2014) Inevitable inequality? Science (Editorial) 344(6186):783

Ding N, Wang Y-G (2007) Power-law tail in the Chinese wealth distribution. Chin Phys Lett 24:2434–2436

Drăgulescu A, Yakovenko VM (2001) Exponential and power-law probability distributions of wealth and income in the United Kingdom and the United States. Phys A 299:213–221

Gabaix X (1999) Zipf's law for cities: an explanation. Q J Econ 114(3):739–767

Ghandi A, Walton M (2012) Where do get Indian billionaires their wealth? Econ Polit Wkly 47(40):10–14

Gibrat R (1931) Les inégalités économiques. Libraire du Recueil Sirey, Paris

Haseler S (2005) The super-rich. In: Matson RR (ed) The spirit of sociology: a reader. Pearson/Ally & Bacon, Boston, pp 241–252

Hazledine T, Siegfried J (1997) How did the wealthiest New Zealanders get so rich? N Z Econ Pap 31(1):35–47

Hilbe JM (2014) Modeling count data. Cambridge University Press, New York

Hvistendahl M (2014) While emerging countries boom, equality goes bust. Science 344(6186):832–835

Jayadev A (2008) A power law tail in India's wealth distribution: evidence from survey data. Phys A 387:270–276

Klass OS, Biham O, Levy M, Malcai O, Solomon S (2006) The Forbes 400 and the Pareto wealth distribution. Econ Lett 90:290–295

Klass OS, Biham O, Levy M, Malcai O, Solomon S (2007) The Forbes 400, the Pareto power-law and efficient markets. Eur Phys J B 55:143–147

Levy M (2003) Are rich people smarter? J Econ Theory 110:42–64
Levy M, Levy H (2003) Investment talent and the Pareto wealth distribution: theoretical and experimental analysis. Rev Econ Stat 85(3):709–725
Levy M, Solomon S (1997) New evidence for the power-law distribution of wealth. Phys A 242:90–94
Marx K (1999 [1867]) Capital. Volume 1 [Das Kapital. Buch 1]. Internet: http://www.marxists.org/archive/marx/works/1867-c1/ch24.htm. Accessed 26 June 2014
Neumayer E (2004) The super-rich in global perspective: a quantitative analysis of the Forbes list of billionaires. Appl Econ Lett 11:793–796
Ogwang T (2011) Power laws in top wealth distributions: evidence from Canada. Empir Econ 41:473–486
Ogwang T (2013) Is the wealth of the world's billionaires Paretian? Phys A 392:757–762
Persky J (1992) Pareto's law. J Econ Perspect 6:181–192
Petras J (2008) Global ruling class: billionaires and how they "make it". J Contemp Asia 38(2):319–329
Piketty T (2014) Capital in the twenty-first century. The Belknap Press of Harvard University Press, Cambridge, London
Reed WJ (2001) The Pareto, Zipf and other power laws. Econ Lett 74:15–19
Sanandaji T (2013) The international migration of billionaires. Small Bus Econ 42:329–338
Sanandaji T, Leeson PT (2013) Billionaires. Ind Corp Change 22(1):313–337
Science (2014) Special section on "The science of inequality". Science 344(6186):818–867
Shorrocks AF (1976) On stochastic models of size distributions. Rev Econ Stud 42(4):631–641
Siegfried JJ, Round DK (1994) How did the wealthiest Australians get so rich? Rev Income Wealth 40(2):191–204
Siegfried JJ, Roberts A (1991) How did the wealthiest Britons get so rich? Rev Ind Organ 6:19–32
Sinha S (2006) Evidence for power-law tail of the wealth distribution in India. Phys A 359:555–562
Steindl J (1965) Random processes and the growth of firms. Hafner, New York
Yakovenko VM, Rosser JB Jr (2009) Colloquium: statistical mechanics of money, wealth, and income. Rev Mod Phys 81(4):1703–1725
Yitzhaki S (1987) The relation between return and income. Q J Econ 102(1):77–96
Zipf G (1949) Human behavior and the principle of last effort. Addison-Wesley, Cambridge

## Data sources

Data source of the Index of Economic Freedom 2014: http://www.heritage.org/index/excel/2014/index2014_data.xls [accessed May 28, 2014]
Data source of the GDP per capita: http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD [accessed May 27, 2014]
Data source average growth rate GDP per capita: http://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG [accessed May 25, 2015]
Data source of the population: http://data.worldbank.org/indicator/SP.POP.TOTL [accessed May 24, 2014]
Data source of the non-income Human Development Index 2012: http://hdr.undp.org/en/data [accessed May 28, 2014]
Forbes list of the world's billionaires 2012: http://stats.areppim.com/listes/list_billionairesx12xwor.htm, updated: 03/12/2012 15:28:41 [accessed May 30, 2014]