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Temporal Relationships between Individualism-Collectivism and the Economy in Soviet Russia: A Word Frequency Analysis using the Google Ngram Corpus.

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Running Head: Individualism-Collectivism and the Economy in Soviet Russia

ABSTRACT

Collectivism and individualism are commonly used to delineate societies that differ in their cultural values and patterns of social behaviour, prioritising the relative importance of the group and the individual, respectively. Collectivist and individualist expression is likely to be intricately linked with the political and economic history of a society. Scholars have proposed mechanisms for both positive and negative correlations between economic growth and a culture of either individualism or collectivism. Here, we consider these relationships across the dramatic history of twentieth and early twenty-first century Russia (1901-2009), spanning the late Russian Empire, the communist state and the growth of capitalism. We sample Russian speakers to identify common Russian words expressing individualism or collectivism, and examine the changing frequencies of these terms in Russian publications collected in Google's nGrams corpus. We correlate normalised individualism and collectivism expression against published estimates of economic growth (GDP and NMP) available between 1961-1995, finding high collectivist expression and economic growth rate followed by the correlated decline of both prior to the end of Soviet system. Temporal trends in the published expression of individualism and collectivism, in addition to their correlations with estimated economic growth rates, are examined in relation to the change in economic and political structures, ideology and public discourse. We also compare our sampled Russian-language terms for individualism and collectivism with Twenge et al.'s (2012) equivalent collection from American-English speakers.

INTRODUCTION

The individualism-collectivism (IC) spectrum is commonly considered the most important of Hofstede's (1976) cultural dimensions, a framework describing the effects of society's culture on the values, cognition, behaviour, and social relationships of its members. Triandis (1995, p. 2) defines *collectivism* "as a social pattern consisting of closely linked individuals who see themselves as parts of one or more collectives <...>; are primarily motivated by the norms of, and duties imposed by, those collectives; are willing to give priority to the goals of these collectives over their own personal goals; and emphasize their connectedness to the members of these collectives". In contrast, *individualism* "is a social pattern that consists of loosely linked individuals who view themselves as independent of collectives; are primarily motivated by their own preferences, needs, rights, and the contracts they have established with others; give priority to their personal goals over the goals of others; and emphasize rational analyses of the advantages and disadvantages to associating with others".

Individualism and collectivism have been analysed as cultural syndromes - a set of cultural characteristics organized around the theme of the individual or group, respectively (Triandis, 1993). Position on the IC spectrum has been connected to a large variety of traits, values, behavioural patterns, and everyday decision making. For instance, the IC spectrum has been related to self-concept (Bochner, 1994; Markus & Kitayama, 1991), cognition (Nisbett, et al., 2001), emotions (Kitayama, et al., 2006), subjective wellbeing (Diener, et al., 2003), choice making (Iyengar & Lepper, 1999), social capital (Putnam, 2000), and language use (Kashima & Kashima, 2003).

Collectivists are thought to pay more attention to norms and values including self-discipline, social order, conformity, social recognition, honouring parents and elders, humility, preserving public image, the value of tradition and the acceptance of life events (Kashima, et al., 1992; Triandis et al. 1993). Triandis et al. (1993) proposed that

collectivism is correlated with resource scarcity, large family size, cooperative agricultural activities. Collectivism might also serve a pathogen defence mechanism, by strengthening in/out-group distinctions (Fincher, et al., 2008).

By contrast, individualists have been related to attitudes and values such as freedom, equality, an exciting life, and enjoyment (Kashima, et al., 1992; Schwartz & Sagiv, 1995). Suggested conditions associated with individualism include affluence, social and geographical mobility, cultural complexity, urbanism, modern mass media, job creation requiring individual pursuits, and the spread of new technologies and ideas (Triandis et al. 1993).

A uni-dimensional IC spectrum is clearly a simplification and evidence suggests individualism and collectivism may coexist within the same population, depending on context (Lau 1992; Singelis, et al., 1995; Schimmack, et al., 2005; Kitayama et al. 2009), or as a result of interaction with a third variable such as authoritarianism or self-reliance (Triandis, et al., 1993; Gelfand, et al., 1996). For instance, Buddhism is common in many so-called collectivist countries and yet emphasises the concept of Karma, requiring responsibility for one's actions and individual freedom within the collective (Sinha, 1988). Similarly, rising individualism in East Asia has occurred while maintaining many traditional collectivist values (Caudill, 1973; Flanagan, 1979; Trommsdorff, 1983; Yang, 1996).

Quantitative research on the IC spectrum is most commonly conducted using cross-cultural surveys and questionnaires. Yet, this can be complimented by evidence in symbolic material culture, such as proverbs, news articles, advertisements, children’s stories and song lyrics (Kashima & Kashima 2003; Morling & Lamoreaux 2008, 2012; Twenge et al. 2012). For instance, Han (1990, cited in Triandis, 1993) found that Korean advertisements more frequently used collectivist themes than American advertisements.

Individualistic words are thought to encourage analytical thinking, while the collectivistic words may emphasise a holistic approach (Oyserman & Lee, 2008). Similarly, grammatical constructs, such as pronoun use, may affect position on the IC spectrum, with first person singular pronouns (I, my, me, mine) encouraging an individualistic orientation, while first person plural pronouns (we, our, us, ours) promote a collectivistic orientation (Na & Choi, 2009; Twenge et al. 2013). Indeed, Kashima & Kashima (2003) suggest that if a language structure does not allow dropping of the first person pronoun, the country is more likely to be individualistic than collectivist.

Published material can provide sources for longitudinal studies of the IC spectrum, although this approach is rarely used. In an exception, Twenge et al. (2012, 2013) found that for the American English Ngram corpus between 1960-2008, there was an increase in words and phrases reflecting individualism, including an increase in first person singular pronouns (I, me) and second person pronouns (you, your), but a decrease in first person plural pronouns (e.g. we, us). Also, a qualitative study by Paretskaya (2010) of Soviet Communist Party discourse between 1970-1986 found movement towards individuality, self-expression, and consumerism in three popular newspapers. Interestingly, this change precedes the economic changes during the period of perestroika (1986-90).

Google's Ngram project is a unique digital repository for the analysis of change in culture through a change in vocabulary and relative word frequencies that is only just beginning to be explored. The corpus consists of over 5 million digitized books, constituting around 6% of all books ever published (Michel et al. 2011). This allows studying cultural change in ways that have never been possible before and provides an insight into "the knowledge about knowledge" (Evans & Foster, 2011). Given the size of the corpus, Ngram studies typically involve analysis of word or phrase frequencies, including topics such as climate science (Bentley, et al., 2012), IC spectrum (Twenge, et al., 2012; Uz 2014; Zeng & Greenfield 2015), expression of emotions in American and British literature (Acerbi, et al.,

2013), word popularity (Perc, 2012; Petersen, et al., 2012b), and expansion of the dictionary (Petersen, et al., 2012a).

Our study focuses on the 20th Century Russian Ngram word frequencies in relation to the IC spectrum, and their correlation with measures of economic change, GDP (Gross Domestic Product) and NMP (Net Material Product), in Soviet Russia. The remainder of the introduction concerns proposed relationships between the IC spectrum and economic change, before considering the historical context of the Soviet Russian case.

We introduce four hypotheses from literature suggesting causal relationships between the IC spectrum and economic growth (reviewed by Ball 2001). While our correlative study is not designed to test these hypotheses, our findings can be compared against their expectations. The first two hypotheses concern the causal effect of IC expression on economic growth, while hypotheses three and four consider the reverse, that is, the causal effect of economic growth on IC expression. Note that feedback between IC and the economy is possible, so hypotheses 1-2 are not necessarily inconsistent from hypotheses 3-4, although much of the literature fails to identify causal precedence between IC and economic change.

Hypothesis one suggests that economic development is impeded by collectivism and facilitated by individualism. The idea that self-interest is good for economic performance can be traced to Adam Smith (1776). Weber (1930) also thought that transition to capitalism can be attributed to the strong work ethic and positive attitude towards saving and investment, which were the products of the protestant worldview (doctrine of predestination). Strong family ties could also increase bureaucratic corruption, favouritism, and nepotism, while the accumulation of family-orientated social capital may slow down economic development (Dasgupta, 2000). Also, individualistic countries may experience long economic growth periods if their culture rewards personal achievements not only financially, but also with high social status (Gorodnichenko & Roland, 2011).

The second theory states that economic development is facilitated by collectivism and impeded by individualism, such that tight social networks and trust might be fundamental for economic development. Arrow (1972) suggested that every economic transaction requires a certain level of trust. Various social dilemmas - 'prisoners' dilemmas, collective action problems, and public goods - have a collectivist solution often supported by adherence to social norms for conditional cooperation (Fehr & Fischbacher 2004). Fukuyama (1995) claimed that collectivist cultures can have more complex economic activities than individualist cultures, because trust can be placed outside the family; he argues that Japan and Germany are such examples. Knack and Keefer's (1997) cross-cultural study of social capital across 29 market economies found trust levels to be positively correlated with income per capita.

The third theory asserts that economic development promotes collectivism and erodes individualism, although this theory is not well supported. Hirschman (1982) reviews the idea that capitalism encourages certain psychological attitudes and morality that will make members of societies more helpful, trusting, and friendly, because such traits are useful in themselves and for further expansion of the system. Rosenberg (1990) argues that Adam Smith believed businessmen to act beneficently only when beneficence pays. Therefore, commercial markets promote cooperation through the importance of reputation, and that over time this can become standard practice (Sugden, 1989). Similarly, Kuznets (1955) argued that wealth facilitates progressive taxation and public assistance to the poor, suggesting that contribution to a social good correlates with wealth.

The fourth and final theory, that development of markets erodes collectivism and promotes individualism, has received the most support. Triandis (1990) noted that as societies become more affluent, the benefits of living in groups are less clear. Yellen's (1990) ethnography of !Kung suggests that wealth correlates with movement away from collectivist living, hoarding instead of gift-giving, and diminishing values of intimacy and

interdependence. While cooperation can enhance public wealth, the rapid growth of wealth can result in defection from cooperative norms (Ball 1999), particularly if mechanisms for punishment of norm-violators are inadequate in a changing social system. Adelman & Morris's (1967) cross-cultural analysis provides evidence that countries with intermediate levels of development are transitional societies where modernization disrupts traditional customs and institutions without sustaining their stable development. Other studies suggest that economic growth correlates with individualism (Yang, 1996; Yang, 1988; Inglehart & Baker, 2000; Allen, et al., 2007). For instance, scholars have noted that economic growth in the United States correlates with a decline in conformity (Alwin, 1989; Bond & Smith, 1996), withdrawal from social groups and institutions (Glenn, 1987; Putnam, 2000), a rise in individualism (Roberts & Helson, 1997; Twenge & Campbell, 2001; Twenge & Campbell, 2008), narcissism (Twenge, et al., 2008), and a decreasing need for social approval (Twenge & Im, 2007). On the other hand, despite the increase in individualism, the importance of family has remained (Thornton & Young-DeMarco, 2001), the external locus of control (e.g. government) has increased (Twenge, et al., 2004), and some studies do not show a temporal change in individualistic attitudes (Trzesniewski & Donnellan, 2010).

Twentieth and early twenty-first century Russia provides an interesting case study to consider IC expression in relation to economic change, having experienced large economic fluctuations and concurrent political change between communist and capitalist systems, which may be closely tied to notions of collectivism and individualism, respectively. For context, we provide a very brief synopsis of this period. The economy of the Soviet Union for much of the 20th century was based on state ownership of the means of production, centralized administrative planning, industrial manufacturing, and collective farming. The production was planned from the top down, which meant that it did not always match real requirements of the amount and the quality of goods; this often created a shortage of certain products while others were overproduced. The production outputs and inputs were

supposed to be determined by one-year and five-year intervals, in addition to longer-term perspective plans, while in reality the results often ended up being quite different from those expectations (Hanson, 2003).

War economy, introduced after the 1917 revolution, resulted in strong opposition, because the state requisitioned the food and gave little in return. In order to overcome dissatisfaction, Lenin introduced NEP (New Economic Policy), which lasted from 1921 to 1929. It was defined by private ownership of artisan and agriculture production, while foreign trade, heavy industry, transport and communications remained controlled by the state (Rosenberg, 1991).

After Lenin's death, Stalin became a leader and introduced the first five-year plan (1928-1932), which was designed to build heavy industry and annul private property. It also established kolkhozes (collective farming systems), but allowed peasants to sell agricultural surplus, even though the food production was below average. The second plan (1933-1937) was similar to the first and emphasized heavy industry. The third plan (1938-1941) was shorter due to World Ward II, so a lot of resources were relocated for military purposes. The fourth and fifth five-year plans (1945-1955) were aimed at economic and agricultural recovery, following the war. The sixth plan (1956-1960), created by Nikita Khrushchev, introduced minimal wages and expanded the production of consumer goods, which raised the living standards. The seventh to eleventh plans (1959-1985) were marked by a marked slowing down of the economic growth and large grain exports, while at the same time increasingly larger amounts of agricultural products had to be imported, which signified the future economic crisis. The twelfth plan (1986-1990) was better known as *perestroika* (restructuring). Its goal was to revive economic growth and improve socialism through the introduction of democratised elections, giving enterprises the responsibility for their input, output, and profit, introducing private ownership of businesses, and allowing

foreigners to invest in the Soviet Union. These reforms created social unrest, introduced more personal and political freedoms, the beginning of capitalism, and weakened censure, which eventually resulted in the collapse of the Soviet Union in 1991 (Kenez, 1999).

After breakup of the Soviet Union, the new separate states started to build a very different form of capitalism than that found in the West or Asia. This has been analysed within a neoclassical sociology framework, rejecting the idea that capitalism is homogenous across space and time and comparing its various forms (Burawoy, 1997). These differences come not only from different geneses, but also from variation in culture and politics, shaped in part by power relations. Russian capitalism was contrasted against the Western variety because of the "pervasiveness of barter" (King, 2002), domination of trade and consumption (Burawoy, 1997), and the lack of a system that could "systematically promote the accumulation of capital" (Lane, 2000). Paretskaya (2010) suggests that capitalism is not only an economic organization, but a broader cultural system, in the same way as is communism. Thus, capitalism can be understood as a cult of individualism, where the individual and self-realization is the focus of the new ideal of life. Transition to capitalism may have been catalysed by the Communist Party itself, promoting individualistic values long before the collapse of the Soviet Union.

Quantitative and qualitative IC spectrum research on Russia appears to differ in conclusion, suggesting that a single IC scale is over-simplistic. Quantitative research using Hofstede's cultural dimensions questionnaire, collected after the collapse of the Soviet Union, typically portrays Russia as having low to moderate levels of individualism (Welsh et al. 1993; Bollinger 1994; Veiga et al. 1995; Puffer & Shekshnia, 1996; Bradley 1999). Hisrich & Grachev (1993) claimed that Soviet Russia was highly collectivist, because it promoted the interests of the state, while Holt, et al. (1994) argued that Russians were

indoctrinated into the socialist value system and that the individual had little freedom to make decisions, making it a collectivist society.

Clearly, the use of Russian language publications as a proxy for the IC spectrum must be considered in light of censorship and propaganda, introduced in 1917 and increasingly strict until 1953 (the death of Stalin). After this year, it was slightly relaxed and some of the censorial responsibilities were allocated to individual editors instead of an official Glavlit institution (censorship agency), but requirements never disappeared completely. Western countries were vilified and certain subjects forbidden to write about until the collapse of the Soviet Union. This might influence the frequency of collectivistic and individualistic words in the Russian corpus, since these two subjects were at the core of the official ideology. However, not everything was controlled by the government, and some artists proceeded to publish their works abroad or illegally, by doing so overcoming censorial practices (Ermolaev, 1997).

Paretskaya's (2010) qualitative analysis of Soviet newspapers (1970-1986) suggests that although collectivism was not abandoned, prior to perestroika official discourse of the Communist Party changed to promote individual uniqueness, encourage independence and consumerism, that later created a basis for capitalist economy. Encouraging such values was a huge step, considering that communist morality typically required "voluntary submission of the individual to the collective will" (Reid 2002, p.219) to such level that even personal and family matters were considered to be in a public domain. Gronow (2003) points to ideological change as a precursor to the end of Soviet communism from as early as the mid-1930s, when asceticism and social egalitarianism was replaced by a new hierarchy of social order and mass production of consumer goods that allowed, for some, a more hedonistic and individualistic way of life.

Most previous studies linking an IC spectrum to economic state are cross-cultural and have not considered temporal change within a country (Twenge, 2006). Although, in a recent

study, Zeng and Greenfield (2015) examined the change in nGram frequency of some Chinese words capturing individualist and collectivist values between 1970 and 2008. They find positive (and negative) correlations between individualist (collectivist) words and indicators of market economy (enrollment in tertiary education, urbanisation and household consumption).

Our study addresses temporal change in IC expression across 20th and early 21st century Russia using the 2012 Ngrams dataset, examining correlations with economic growth, and the change in IC expression in relation to the emergence of a capitalist economy. The prevalent view in the literature is that individualism will be more closely related to economic growth than an increase in collectivism, and that expressions of individualism may precede changes in economic policies towards a capitalist system.

METHODS

The methods are in two parts. First, Russian words associated with either individualism or collectivism were identified by sampling Russian speakers. Next, the frequencies of these words were examined in Google's Ngram corpus for 1901-2009, and normalised frequencies (explained below) were compared against records of economic change in Soviet Russia, available for 1961-1995.

Identification of Individualist and Collectivist words

Using a questionnaire, lists of words associated with 'individualism' and 'collectivism' were submitted by 56 Russian speakers, recruited from online social networking sites, teachers at Russian schools, and workers at Russian cultural centres in Lithuania and the United Kingdom. Information was also collected on participant gender, age, mother tongue, and other known languages. Duplicate words and incorrectly completed questionnaires were removed, and spellings were corrected. Different grammatical forms of the same word,

such as verb and adverb or singular and plural, were not eliminated since they might convey different meaning (Twenge et al. 2012).

We report analysis of common words, submitted at least 4 times, to avoid words with obscure or rarely held interpretation of meaning. Pronouns are excluded as they are so commonly used in a variety of forms and contexts that the extent to which they accurately relate to the IC spectrum is unknown. Also, their frequencies are orders of magnitude greater than other IC words in the Russian Ngram corpus, thus swamping any patterns found among non-pronoun IC words. We only considered single words (one-grams) and not phrases, because Russian sentence construction is typically loose, so there can be phrase variation caused by change in word order without change in meaning.

Google Ngram Analysis

The Google Ngram corpus is divided into several main languages - English, French, Spanish, Italian, German, Chinese, Hebrew, and Russian, with two datasets for each language - 2009 and 2012. We use the most recent dataset, consisting of approximately 8 million books (6% of all books ever published; Lin, et al., 2012). Because of its size, it cannot be analysed or read manually, but it can be studied quantitatively by calculating the frequencies of digitized Ngrams, that is, strings of *n* words. We extracted the number of times each common IC word (submitted ≥4 times in the questionnaire phase) was mentioned in each year of the Russian corpus, from 1901 to 2009.

In similar studies using the English Ngrams corpus (Acerbi et al., 2013; Twenge et al., 2012), word frequencies were normalised to account for variation in annual publication rate by expressing word frequency as a proportion of the frequency of the most common word, "the". Russian does not have an equivalent to "the", so we followed Michel et al.'s (2010) normalization method, by dividing each annual frequency by the total number of (Russian) words published in the given year. Following Twenge et al. (2012) and Bentley et al. (2014), we then transformed the frequencies into z-scores to allow direct

comparison between individualist and collectivist frequencies relative to their own overall means. This technique effectively partials out the overall difference in mean individualist and collectivist publication rates, and standardises the range of values as a proportion of the variation in either individualist or collectivist frequencies across the years under study, giving

$$Z_{x,t} = \frac{\bar{f}_{x,t} - \mu_x}{\sigma_x}, \qquad \text{[eqn.1]}$$

where x stands for either individualist or collectivist words; $\bar{f}_{x,t}$ is the mean frequency of type x in year t; μ_x is the overall mean for type x across all years, and σ_x is the associated standard deviation of type x across all years.

In addition to correlation statistics, the IC words were analysed qualitatively by comparing their meanings with the results from a similar research article that produced 20 American collectivistic and individualistic words (Twenge et al., 2012).

Economic Measures

We use Kuboniwa's (1997) values of GDP and NMP growth rates estimated for the period 1961-1995. We consider both GDP and NMP as there has been debate over their accuracy of application to Soviet Russian history (Lavigne 1999; Harrison 2003; Noren 2003; Rosefielde 2003; Rosefielde & Kuboniwa 2003). Kuboniwa acquired the official NMP growth rates from Goskomstat (the Russian statistics office) databases.

NMP includes only the values of material production sectors, but not services sectors such as healthcare, education, or finance. Unlike the GDP system, it also includes indirect taxes, but does not account for the depreciation of fixed assets and relies on historical acquisition prices rather than replacement costs, which likely overstates the output.

To translate NMP value to GDP, one would have to estimate the values of services, many of which were provided for free, convert domestic prices into dollars, while the currency of

the Soviet Union was overvalued and non-convertible (e.g. multiple currencies existed at the same time and therefore different exchange rates were applied to different product groups). Also, one would have to take into account that all the prices were fixed and distorted (Lavigne, 1999). Despite these impediments, Kuboniwa (1997) approximated GDP values for 1961-1995, by estimating sectorial real growth rates, calculated directly from the official data on industrial production, agricultural and forestry output, construction works, freight and passenger transportation, retail turnover, and other services. These estimates were compared with the real economic data collected after the collapse of the Soviet Union and exhibited an adequate level of accuracy.

Economic measures of Soviet Russia prior to 1960 are unreliable, although we note that Laving (1999) reports official, Western and alternative NMP measures of economic wealth to be high between 1922-40, and 1951-1960, while official and alternative measures estimate low levels from 1941-50.

RESULTS

IC Questionnaire

There were 56 respondents (45 women, 11 men) with an age range 19-76 years (women mean 40.4 with range 19-76; men mean 33.6 with range 20-52). All respondents declared themselves fluent in Russian, and for 49 it was their mother tongue. Four answer sheets were rejected because they were completed incorrectly (e.g. people submitted phrases or long definitions of individualism and collectivism instead of single words).

The questionnaire sample used to generate IC words had a high proportion of women, approximately 86%. According to Ries (1997), Russian men and women construct their narratives differently, emphasizing and representing opposite values and roles (e.g. male mischief stories versus female lamentations). Such gender bias was not noticed in the

words produced. Similarly, age, nationality, and known languages appeared not to have an effect on the chosen words.

In regard to the wide age distribution (19-72 years), Twenge et al. (2012) raises the concern that the elderly may produce different lists than young adults, by recalling words that were common in their youth but not necessarily amongst the contemporary young. To the contrary, we found that lists made by different age groups consisted of very similar words. This might suggest that the meaning of IC words has not altered much during the last century, or that the elderly have taken up contemporary IC words, although this is not something we have tested.

In total, we collected 367 individualistic and 390 collectivistic words, consisting of 191 and 194 unique words (total 385), respectively. Of these, 346 words (170 individualistic and 176 collectivistic) were represented in the Ngrams corpus (see Supplementary Information for the full word with translations). Table 1 shows the common IC words (submitted ≥ 4 times in the questionnaire phase) collected from the questionnaire which we applied to the Russian Language Ngrams corpus.

Table 1

(a) Russian

Collectivism			Individualism		
Word	Translation	No.	Word	Translation	No.
Семья	family	14	личность	identity	16
Группа	group	12	эгоизм	selfishness	12
коллектив	collective	12	независимость	independence	10
общество	society	12	свобода	freedom	9
взаимопомощь	mutual aid	9	индивидуальность	individuality	7
Вместе	together	8	самостоятельность	independence	7
поддержка	support	8	уникальность	uniqueness	7
Дружба	friendship	7	индивидуум	individual	5
Колхоз	kolkhoz	7	один	one	5
Команда	team	7	характер	character	5
Общее	common	6	индивид	individual	4
Единство	unity	5	одиночество	loneliness	4
Община	community	5	собственник	owner	4
Толпа	crowd	5	собственность	property	4
альтруизм	altruism	4	собственный	own	4
Друзья	friends	4	эго	ego	4
Народ	people	4			
Помощь	help	4			

(b) American English (from Twenge 2012)

Individualism	Collectivism
independent	communal
individual	community
individually	commune
unique	unity
uniqueness	communitarian
self	united
independence	teamwork
oneself	team
soloist	collective
identity	village
personalized	tribe
solo	collectivization
solitary	group
personalize	collectivism
loner	everyone
standout	family
single	share
personal	socialism
sole	tribal
singularity	union

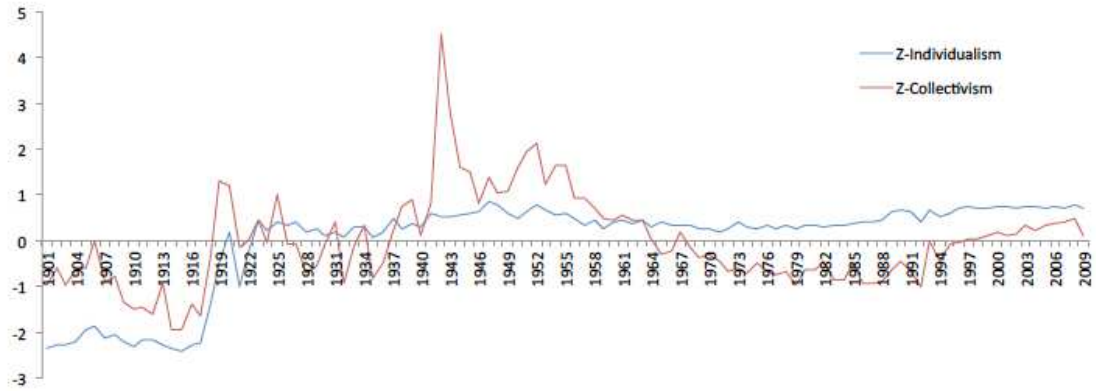
Table 1. Words associated with the concepts of Collectivism and Individualism (a) collected from Russian speakers and ordered by number of occurrences, and (b) reproduced from Twenge et al.'s (2012) top-20 list collected from American-English speakers.

Ngrams Analysis

Russian-language publications in the Ngrams corpus date from 1607 to 2009, with variation in words count published from 834 in 1742 to 1,250,694,132 in 1989. Within the analysed period (1901-2009), there is a considerable fluctuation in word frequency. For instance, in 1942 the total number of words represented in the corpus constitute only 17% of the words in 1940 (approximately 4 times fewer books), resulting in the absence of some rare words. Furthermore, it can be seen how words specific to the Soviet era became part of everyday language as their frequency rapidly increased after a specific economic reform or regime change. For example, колхоз (*kolkhoz*) and коллективизация (*collectivization*) were first mentioned only in 1917, the year of the October (Bolshevik) Revolution. Neither kolkhozes nor collectivisation took place during that year, although these concepts might have been used by the revolutionaries to attract people and explain their plans.

Figure 1

(a) Z-scores



(b) Absolute proportions

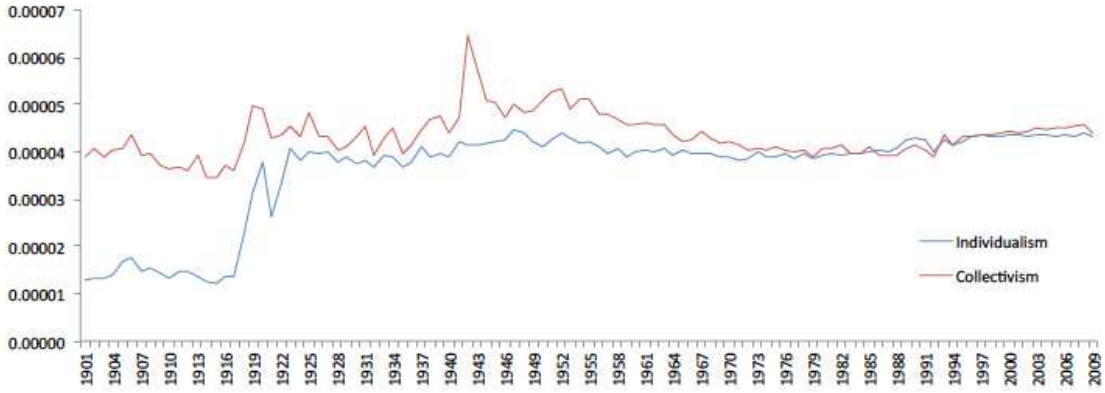


Figure 1. Russian nGram frequencies for Russian collectivist and individualist terms across years, expressed as (a) z-scores, and (b) absolute proportions of total word count for each year.

Our analysis principally focuses on z-scores rather than absolute frequencies as the former controls for overall prevalence. Figure 1 shows that while the temporal patterns of z-scores and absolute frequencies are similar, the latter exhibits a relatively elevated collectivist line

compared to the former. Figure 1a shows a rapid rise in collectivism z-scores, and even more markedly in individualism z-scores, from 1917 to 1921, following the October Revolution. Both z-scores remain at a similar level for the next four decades, although the collectivism z-scores exhibit greater fluctuation over this period, with an extraordinary spike in 1942-43, during World War II. From 1960 until the end of the researched period (2009), individualism z-scores are higher than those for collectivism. Individualism z-scores increase slightly with perestroika, reaching a peak in 1990, the year before the collapse of the Soviet Union. Collectivism z-scores recover to achieve positive values in the post-Soviet era.

All the correlative results below are also reproduced in a table in the Supplementary Information. Note that the effect sizes for all significant results are medium or high (based on Cohen 1988; Medium: ρ = .3; High: ρ = .5) Over the full time period (1901-2009; see Figure 1), individualism (Spearman's $\rho(109) = 0.72$, $p < .001$), but not collectivism ($\rho(109) = .14$, $p = .14$) z-scores show a significant positive correlation with year. Consistent with these findings, there is a significant positive correlation between the difference in individualism and collectivism z-scores (individualism z-score minus collectivism z-score) and year ($\rho(109) = .70$, $p < .001$). Overall there is a significant positive correlation in individualism and collectivism z-scores ($\rho(109) = .62$, $p < .001$).

Over the communist period between 1917-1985 (between the October Revolution and perestroika), there is a significant negative correlation between collectivism z-scores and year ($\rho(69) = -.34$, $p = .008$), but no significant correlation between individualism z-scores and year ($\rho(69) = .21$, $p = .09$). The lack of relative increase in word frequencies across the communist period suggests the absence of a preference for new, recent words across this period. Consistent with these findings, there is a significant positive correlation between the difference in individualism and collectivism z-scores and year ($\rho(69) = .54$, p

< .001), indicating a relative increase in the scaled frequency (i.e. z-score) of individualism words relative to collectivism words. Nonetheless, there is a significant positive correlation in individualism and collectivism z-scores over this period ($\rho(69) = 0.64$, $p < .001$).

From the period of perestroika onwards (1986-2009), both individualism ($\rho(24) = 0.77$, $p < .001$) and collectivism ($\rho(24) = 0.93$, $p < .001$) z-scores correlate positively with year. There is a significant negative correlation between the difference in individualism and collectivism z-scores and year ($\rho(24) = -.92$, $p < .001$), reflecting the reduction in disparity of individualist over collectivist z-scores. As in the communist era, there is a significant positive correlation in individualism and collectivism z-scores over this period ($\rho(24) = 0.86$, $p < .001$).

Figure 2

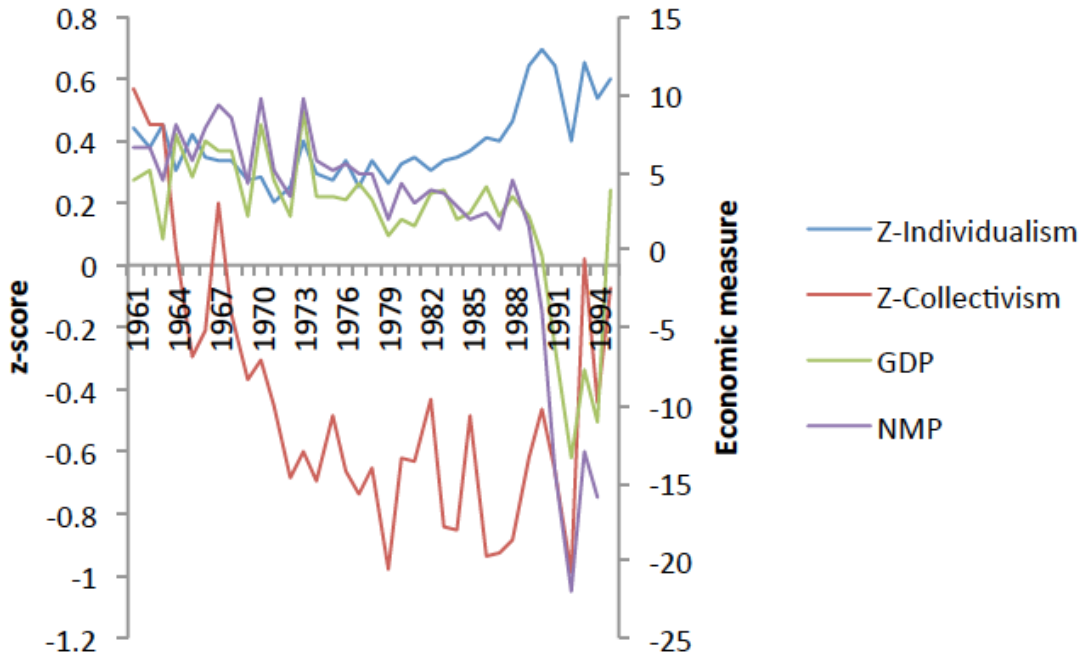


Figure 2. Russian nGram z-scores for Individualism, Collectivism and two measures of economic growth rate (GDP and NMP) across years.

Over the period for which we have economic data (1961-1994; see Figure 2), the two economic measures (GDP and NMP) are positively correlated ($\rho(34) = .88$, $p < .001$), and each declines significantly with year (GDP: $\rho(34) = -.68$, $p < .001$; NMP: $\rho(34) = -.84$, $p < .001$). Over the same period, there is no significant correlation between individualism and collectivism z-scores ($\rho(34) = .12$, $p = .49$).

Collectivism z-scores are positively correlated with both GDP ($\rho(34) = .37$, $p = .03$) and NMP ($\rho(34) = 0.49$, $p = .003$), while individualism z-scores are negatively correlated with NMP ($\rho(34) = -0.39$, $p = .02$), but marginally significant with GDP ($\rho(34) = -.34$, $p = .05$). Consistent with these findings, the difference in individualism and collectivism z-scores correlates negatively with both GDP ($\rho(34) = -.50$, $p = .003$) and NMP ($\rho(34) = -.68$, $p < .001$). Note that the period for these correlations includes the dramatic drop in both GDP and NMP, commencing in 1990, the year before the collapse of the Soviet Union.

As we are interested in the relationship between IC expression and economic measures during the communist period, we use our available data to analyse 1961-1985, prior to perestroika. During this era, we find individualism z-scores do not significantly correlate with either GDP ($\rho(25) = .08$, $p = .70$) or NMP ($\rho(25) = .18$, $p = .39$), while similar to 1961-1995, there is a significant positive correlation between collectivism z-scores and both GDP ($\rho(25) = .47$, $p = .02$) and NMP ($\rho(25) = 0.59$, $p = .002$). We note that qualitatively similar effects remain if we assume that IC expression is delayed by publication time for 1-3 years (see Supplementary Information). The difference in individualism and collectivism z-scores correlates negatively with NMP ($\rho(25) = -.50$, $p = .02$) but not significantly with GDP ($\rho(25) = -.31$, $p = .13$). Note that, unlike individualism z-scores, collectivism z-scores steadily decline over this period (individualism: $\rho(25) = -.24$, $p = 0.24$; collectivism: $\rho(25) = -.80$, $p < .001$).

From perestroika onwards (1986-1995), there is no significant correlation during this turbulent period between either individualism z-scores or collectivism z-scores and the economic measures (NMP: $\rho(9) = -.03$, $p = .93$ and $\rho(9) = -.17$, $p = .67$, respectively; GDP: $\rho(9) = -.07$, $p = .87$ and $\rho(9) = -.27$, $p = .49$, respectively).

DISCUSSION

Our analysis indicates that Russian published IC expression only partially conforms to general hypotheses advocating a positive relationship between either individualism or collectivism, and economic value. In particular, that economic measures positively correlate with expressions of collectivism but not individualism during the measured communist period (1961-1985), is contrary to the theoretical expectation that individualism correlates positively with economic value.

The co-occurence of high levels of collectivist expression and economic value at the beginning of the 1961-1985 period is consistent with the theories advocating a positive relationship between economic measures and expressions of collectivism: that collectivism encourages economic growth, relying on the benefits of collective action, or that economic growth supports collectivism. Yet, collectivist expression and economic value are positively correlated because they both decline over this time period. Thus, the initial high levels of collectivist expression and economic value appear to have been unstable and neither theory explains their subsequent decline.

It is unfortunate that reliable and comparable economic data is not available for the entire communist period. Prior to the 1960s, the centrally planned Soviet economy allowed industrialization and modernization of the whole country, which resulted in the larger production outputs and therefore higher rates of economic growth values (Harrison, 2003). The collectivist nature of the Soviet society, and especially its vertical collectivist structure

enforced through Communist authorities (Triandis, 1995), was a key feature that allowed policies aimed at long-term economic growth, despite extreme poverty induced at the time of their implementation (Service, 2009). Thus, there was likely a positive correlation between collectivist expression and economic growth during the communist period in the first half of the 20th century.

Theories (one and four) suggesting that individualism should be positively correlated with the economic growth are not supported. Indeed, over the entire period (1961-95) we find some evidence of a negative correlation. This appears to be caused by the post-Soviet economic slump during the birth of capitalism. By contrast, theoretical predictions of a positive correlation between economic growth and individualism are typically related to established capitalist modes of economy where increasing GDP is most likely correlated with perceived increase in wellbeing, rather than states in transition to capitalism (Inglehart & Baker, 2000; Allen, et al., 2007). In Soviet Russia, the economy grew fastest when the living conditions were at their worst, while the slowing down of growth was directly related to increased freedoms, comfort, privacy, and goods made for personal use, which could also explain the decline in published expressions of collectivism during the same period.

The results suggest that published expressions of individualism relative to collectivism increased prior to the appearance of capitalism. Officially, the collapse of the Soviet Union in 1991 induced rapid privatisation and official capitalism, although foundations for this were placed many years earlier. Gorbachev's 1986 Economic reforms as part of perestroika are often considered to indicate the end of communism, yet historians have noted that change in economic ideology can also be observed much earlier.

Discourse within the Communist Party changed following Stalin's death (1953) and Khrushchev's appointment as the new general secretary of the communist party, resulted in political reform; so-called de-Stalinization. It is from approximately this point that we

observe the decline of collectivist expression in the nGrams corpus until the collapse of the Soviet Union. Khrushchev relocated more resources to consumer industries, improved living standards, and launched a mass housing campaign which guaranteed homes with more privacy (Chernyshova, 2013). Kosygin's economic reform of 1965 allowed enterprises to self-manage and make profits as an experiment, and was later expanded (Service, 2009). The relative increase in expression of individualism over collectivism may not only be due to social and economic change, but also as a result of moving censorship duties from Glavlit (central censorship agency) to individual editors, increasing their independence. Literary stories from this period paid more attention to emotional life and individual experiences than before, and did not only concentrate on the collective (Ermolaev, 1997). But, this appears not to be reflected by an increase in individualism expression in the nGrams corpus, which does not appear until much later, in 1990.

Individualism and collectivism significantly correlated with each other over the researched period (1901-2009), but not during the period of economic analysis (1961-1995). This overall correlation suggests that individualism and collectivism might not be at the opposite ends of a linear IC spectrum, from which the expectation would be a negative correlation. It is plausible that the IC dimension interacts with other factors, such as authoritarianism (Gelfand, et al., 1996). Similar doubts have been expressed by Schimmack, et al. (2005) and Singelis, et al. (1995) who also failed to find a negative correlation in responses given to Hofstede's questionnaire.

A lack of negative correlation in the published literature does not necessarily rule out a linear IC spectrum. Our word frequency analysis is insensitive to the context in which collectivist or individualist terms are being used. Literature promoting collectivism may include high frequencies of both collectivist and individualist terms to make positive and negative arguments, respectively. Thus, individualism and collectivism may covary in published literature due to variation in the relative importance of IC concepts even if IC

concepts are conceptually in opposition. This issue could be addressed in future studies by examining within-text covariation.

A relevant pattern in the nGrams corpus is the sharp increase in both individualism and collectivism z-scores between 1917-21, which coincides with the October Revolution (1917) when Bolsheviks gained power, instigating censorship and education reform, aimed to increase literacy throughout the country so that people could be educated by Soviet literature and propaganda (Ermolaev, 1997; Service, 2009). The increase in published expression of both individualism and collectivism may simply reflect a burst in publication output. In addition, collectivist-orientated propaganda may have included explicit arguments against individualism.

Another striking fluctuation is a spike uniquely in collectivism z-scores between 1942-43. This historical period is marked by Russia's participation in World War II, and specifically the opening of the Eastern Front which relegated battle to Russia's territory. Material and human resources were relocated from all areas to war needs and mobilization of an army (Harrison, 1998). While the published output represented in the Russian nGrams corpus was considerably smaller in 1942 than in 1940, during wartime, propaganda generally emphasizes collectivist values, nation, and family (e.g. Brewer, 2009). In addition to this type of rhetoric, the collectivism spike may reflect the mood of the Russian people, which, in times of perceived external threat may encourage collectivist action, expressions of unity, and strengthening of social capital (Putnam, 2000).

The list of most common Russian IC words from the questionnaire (Table 1) is useful not only as a key to analyse Ngram frequencies, but also to consider meanings associated with individualism and collectivism which may vary across cultures. As noted by Triandis (1972 p. 41), "the etic construction, which is emically defined in culture, can be used to make cross cultural comparisons". Comparison of the individualist and collectivist words reported in our Russian study and Twenge et al.'s (2012; Table 2) American-English list

reveal a number of differences in meaning (albeit note these differences are identified from the perspective of the authors, fluent in British-English and Russian and familiar with some historical context. Further analysis would benefit from an emic approach to address American and Russian culturally- and historically-specific meanings).

Russian individualism words include terms that the participants may have associated with negative aspects of a person's personality, namely эгоизм (*selfishness*), одиночество (loneliness), and эго (ego). By contrast, these terms were absent from Twenge et al., and instead the American individualistic words may have carried a more neutral or positive tone, such as *standout, soloist, singularity, solitary* and *unique*(*ness*) with perhaps the exception of *loner*. Both lists associated individualism with independence; however, Russian speakers added a more specific meaning to it - *freedom* - a quality that is not only related to the power structures, but also signifies personal ability to make choices and express oneself.

Russian speaking participants also related individualism with property relations: собственник (*owner*), собственность (*property*), and собственный (*own*) all make this list, although similar words are not mentioned by Americans. This matches expectations, since the property relations and the opposing notions of personal and collective ownership were central to the Soviet ideology (Field, 2006). Ownership of wealth was often demonized and associated with selfishness, defying the collective good or even linked to criminal enterprises (Ledeneva, 1998). Thus, both negative personal qualities and a concept of personal ownership may contribute to a Russian understanding of individualism, while it is likely that Americans understand private property as a basic right that does not require a special mention related to personality and moral behaviour.

Similar trends can be observed for the collectivistic words; both nations produced the same basic words describing communal organizations - *team*, *collective*, *family*, etc., suggesting that a core understanding of collectivism is similar. Personal qualities were accentuated

less than for the individualism lists, while interpersonal behaviours became more important. While the American list had two words marking dependence on others (*teamwork, share*), Russians emphasized (often unilateral) support - взаимопомощь (*mutual aid*), поддержка (*support*), дружба (*friendship*), альтруизм (*altruism*), and, finally, помощь (*help*). This is again related not only with higher levels of collectivism, but also with the official discourse and economic realities. The importance of mutual dependence in Russian society cannot be over-emphasized; the decades of material shortages increased people's dependence on one another and on their social networks (Ledeneva, 1998). Furthermore, the official ideology encouraged self-managing cooperatives (houses, kolkhozes, etc.) and emphasized the importance of generosity, collective labour, and brotherhood (Field, 2006). Economically, collective efforts were important in the state's enterprises as well as in the black markets. It allowed the development of the social institution of блат (*blat*) - unofficial (and often illegal) services and favours exchange system based on reciprocal altruism and trust rather than material elements (Ledeneva, 1998). In contrast, egoism and selfishness, or unwillingness to participate in the mutual reciprocity system, were often seen as the biggest fault of individualistic people.

Finally, it seems that both cultures associated collectivism with the Socialist system. Americans mentioned *collectivisation* as well as *socialism*, while Russian-speaking respondents expressed this connection through a very Russian-specific concept колхоз (*kolkhoz*), which most likely reflects their level of familiarity with the Socialist regime.

Conclusion

Our analysis of Russian IC expression using Google's nGram corpus, illustrates how published Russian IC expression across the twentieth century reflects the changing public discourse, influenced by cultural values and the dramatic political history set in the context

of fluctuating state-level and personal wealth. Marked changes in expression accompany both the beginning and end of the communist period while the external impact of the second world war causes a dramatic spike in collectivist expression.

Our analysis suggests that published IC expression provides some support for the positive relationship between collectivist expression and economic value through central planning and stimulation of the economy under the early communist regime. Our data then show the clear decline of collectivist expression and the Russian economy, commencing several decades prior to the breakup of the Soviet Union. In addition to population-level measures of wealth, further cross-cultural research should consider measures of wealth inequality, such as the Gini coefficient, with the prediction that inequality may covary with individualism and the decline in collectivism. The Google Ngram corpus provides a rich resource for examining such issues cross-culturally, and to further understanding of Russian language in relation to their rich cultural, political and economic history.

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Supplementary Information

Full list of words collected from IC questionnaire:

Individualistic	Translation	Collectivistic	Translation
автономия	autonomy	агитация	agitation
автономность	autonomous	азиаты	Asians
агрессия	aggression	альтруизм	altruism
активный	active	анархия	anarchy
амбиция	ambition	армия	army
важный	important	бабушка	grandmother
вера	faith	банда	gang
внешность	appearance	благотворительность	charity
внимания	attention	большинство	most
внутреннее	internal	братство	brotherhood
вседозволенность	permissiveness	ватага	gang
выбор	choice	взаимовыручка	mutual
выделяющийся	exuding	взаимодействие	interaction
вызов	call	взаимоотношения	mutual relations
высокомерие	arrogance	взаимопомощь	mutual aid
главенство	superiority	взаимопонимание	understanding
голос	voice	вместе	together
гордость	pride	внимание	attention
девиации	deviation	война	war
действительный	valid	все	all
демократия	democracy	выручка	revenue
дисциплина	discipline	гильдия	guild
дом	house	гостеприимство	hospitality
думать	think	государство	state
егоизм	egoism	группа	group
единица	unit	делить	share
единичность	oneness	деревня	village
единоличник	individual peasant	дискуссия	discussion
единственный	only	довериться	trust
живой	live	другие	others
зависть	envy	дружба	friendship
закрытость	closed	дружелюбие	friendliness
замкнутость	insularity	дружно	together
идеи	ideas	дружный	amicable
изобретательность	ingenuity	друзья	friends
изолированность	disconnection	единомышленники	supporters
изоляция	insulation	единство	unity
изюминка	zest	единый	single
индивид	individual	жертвенность	sacrifice
индивидуализм	individualism	забота	care
индивидуальность	individuality	зависимость	dependence
индивидуальный	individual	зависимый	dependent
индивидуум	individual	квартет	quartet
инициатива	initiative	клан	clan

интерес	interest	класс	class
интересный	interesting	коллектив	collective
интимный	intimate	количество	number
интровертность	introversion	коллеги	colleagues
исключительный	exceptional	коллективизация	collectivization
исключительность	exclusiveness	коллективизм	collectivism
капитализм	capitalism	колхоз	kolkhoz
коммуникабельный	communicative	колхозы	collective
конкуренция	competition	команда	team
либерализм	liberalism	коммунальность	communality
лидер	leader	коммунизм	communism
лидировать	lead	коммуникабельный	communicative
лик	face	компания	company
лицо	face	компромис	compromise
личность	identity	конгломерат	conglomerate
личный	personal	конклав	conclave
маё	my	концерт	concert
мечты	dreams	кооперация	cooperation
мещанство	philistinism	кружки	mugs
мировоззрение	ideology	кружок	circle
мне	me	лидер	leader
мнение	opinion	лобби	lobby
мое	my	локоть	elbow
моё	my	любовь	love
моему	my	люди	people
мой	my	манипуляция	manipulation
монохронность	monochronal	масса	weight
моя	my	мир	world
мысль	thought	митинг	meeting
нарциссизм	narcissism	много	many
недоверие	distrust	многочисленный	numerous
независимость	independence	множество	many
неординарность	originality	мораль	morality
неповторимость	soleness	мультикультурализм	multiculturalism
неповторимый	unrepeatable	мы	we
неподражаемый	inimitable	нам	us
непохожесть	otherness	народ	people
облик	image	нация	nation
обособленность	isolation	наш	our
образ	image	наше	our
общительный	sociable	недоверие	distrust
одежда	clothing	обобщение	generalization
один	one	обобщенность	generality
одиночество	loneliness	общак	common fund
одиночка	loner	общее	common
окружающий	ambient	общежитие	hostel
он	he	общение	communication
она	she	общепринятое	common
оригинал	original	общество	society
оригинальность	originality	общий	general
особенность	feature	община	community
особенный	special	общительность	sociability

ответственность	responsibility	общительный	sociable
отдельность	rift	общность	community
отдельный	separate	объединение	union
отделять	separate	обязанности	responsibility
отстраненность	detachment	они	they
отчуждённость	estrangement	организация	organization
отшельник	hermit	отзывчивость	tenderness
очертания	outlines	открытость	openness
партнер	partner	партия	party
персона	persona	пассивность	passivity
подавление	suppression	патриотизм	patriotism
позитивный	positive	планирование	planning
положительный	positive	плечо	shoulder
походка	gait	плюрализм	pluralism
права	right	поддержка	support
практичность	practicality	подчинение	submission
приспособленчество	opportunism	политика	policy
противостояние	opposition	помощь	help
работа	work	понимание	understanding
равнодушие	indifference	порицание	censure
различать	distinguish	поток	flow
разобщённость	disunity	похожесть	similarity
ранимость	vulnerability	праздник	holiday
рационализм	rationalism	предрассудок	prejudice
реклама	advertisement	принадлежность	accessory
решение	decision	прошлое	past
решимость	will	равенство	equality
сам	self	работа	job
самовлюблённость	narcissism	радушие	cordiality
самовыражение	self-expression	распределять	distribute
самодостаточность	self-sufficiency	религия	religion
самомнение	Conceit	родственники	relatives
самоограничение	self-restraint	родство	kinship
самоопределение	self-determination	русские	Russian
самоотверженность	selfishness	связь	link
саморазвитие	self-development	секта	sect
самореализация	self-realization	семья	family
самореклама	self-promotion	серость	greyness
самостоятельность	independence	синхронность	timing
самоуважение	self-esteem	собирательный	collective
самоуверенность	confidence	соборность	catholicity
самоутверждение	self-affirmation	собрание	meeting
свобода	freedom	собутыльники	cronies
свое	their	совет	advice
своеобразность	distinctiveness	совещание	meeting
своеобразный	peculiar	совместность	compatibility
свой	its	совхоз	state farm
сдержанность	discretion	согласие	consent
себелюбие	selfishness	солидарность	solidarity
себя	yourself	сообща	together
сила	force	сообщество	community
скрытность	secretiveness	сообществосоциум	soobschestvosotsium

скрытый	hidden
снобизм	snobbery
собственник	owner
собственничество	possessiveness
собственное	own
собственность	property
собственный	own
современность	modernity
сознание	consciousness
солипсизм	solipsism
соревнование	competition
сотрудничество	cooperation
стиль	style
стремление	aspiration
творчество	creation
темперамент	temperament
терпение	patience
трибуна	tribune
тщеславие	vanity
ты	you
уверенность	confidence
увлечения	hobby
уникальность	uniqueness
фигура	figure
характер	character
холод	cold
холодность	coldness
целостность	integrity
цельность	wholeness
центр	Centre
человек	human
эго	ego
эгоизм	egoism
эгоист	egoist
эгоистичность	selfishness
эгоистичный	selfish
эгоцентризм	egocentrism
эксклюзив	exclusive
экстраординарность	extraordinariness
эмоциональность	emotionality
яркость	brightness
соседи	neighborhood
сострадание	compassion
сотрудники	staff
сотрудничество	cooperation
социализм	socialism
социальное	social
социум	society
союз	union
сплетни	gossip
сплоченность	cohesion
ссоры	quarreling
ссср	ussr
стадность	gregariousness
стадо	herd
страна	country
структура	structure
субботники	subbotniki
товарищ	comrade
толерантность	tolerance
толока	Cleanup
толпа	crowd
традиция	tradition
трудолюбие	industry
уважение	respect
утопия	utopia
уют	comfort
фашизм	fascism
школа	school
щедрость	generosity

Table of main correlation results reproduced from the main text:

Year	Individualism	Collectivism	GDP	NMP	Spearman correlation
All years, 1901-2009					
✓		✓			$\rho(109)=0.143$, p=0.138
✓	✓				$\rho(109)=0.721$, p<0.001
	✓	✓			$\rho(109)=0.617$, p<0.001
Communism, 1917-1985					
✓		✓			$\rho(69)=-0.319$, p=0.008
✓	✓				$\rho(69)=0.205$, p=0.091
	✓	✓			$\rho(69)=0.644$, p<0.001
Perestroika, 1986-2009					
✓		✓			$\rho(24)=0.926$, p<0.001
	✓				$\rho(24)=0.771$, p<0.001
	✓	✓			$\rho(24)=0.864$, p<0.001
Economic data, 1961-1994					
			✓	✓	$\rho(34)=0.879$, p<0.001
✓			✓		$\rho(34)=-0.679$, p<0.001
✓				✓	$\rho(34)=-0.843$, p<0.001
	✓	✓			$\rho(34)=0.122$, p=0.493
		✓	✓		$\rho(34)=0.367$, p=0.033
		✓		✓	$\rho(34)=0.489$, p=0.003
	✓		✓		$\rho(34)=-0.339$, p=0.05
	✓			✓	$\rho(34)=-0.385$, p=0.024
Economic data & Communism, 1961-1985					
	✓		✓		$\rho(25)=0.08$, p=0.702
	✓			✓	$\rho(25)=0.181$, p=0.388
		✓	✓		$\rho(25)=0.471$, p=0.017
		✓		✓	$\rho(25)=0.586$, p=0.002
✓	✓				$\rho(25)=-0.243$, p=0.242
✓		✓			$\rho(25)=-0.802$, p<0.001
Economic data & Perestroika					
	✓		✓		$\rho(9)= -0.067$, p=0.865
	✓			✓	$\rho(9)=-0.033$, p=0.932
		✓	✓		$\rho(9)=-0.267$, p=0.488
		✓		✓	$\rho(9)=-0.167$, p=0.668

Table of correlations between economic wealth and IC frequency for the communist period where, IC values associated with the economic wealth in year t (1961-1985) are given by the measured IC z-values for year $t + t\_lag$, where t_lag=(0, 1, 2, 3). These correlations explore the possibility that publication takes t_lag years, so the published material may be associated with economic wealth t_lag years prior to the year of publication.

Lag (years)	Individualism	Collectivism	GDP	NMP	Spearman correlation
0	✓		✓		$\rho(25)=0.08$, p=0.702
0	✓			✓	$\rho(25)=0.181$, p=0.388
0		✓	✓		$\rho(25)=0.471$, p=0.017
0		✓		✓	$\rho(25)=0.586$, p=0.002
1	✓		✓		$\rho(25)=-0.015$, p=942
1	✓			✓	$\rho(25)=-0.220$, p=0.290
1		✓	✓		$\rho(25)=0.219$, p=0.293
1		✓		✓	$\rho(25)=0.414$, p=0.040
2	✓		✓		$\rho(25)=-0.295$, p=0.153
2	✓			✓	$\rho(25)=-0.367$, p=0.071
2		✓	✓		$\rho(25)=0.534$, p=0.006
2		✓		✓	$\rho(25)=0.391$, p=0.054
3	✓		✓		$\rho(25)=-0.052$, p=0.804
3	✓			✓	$\rho(25)=-0.276$, p=0.181
3		✓	✓		$\rho(25)=0.406$, p=0.044
3		✓		✓	$\rho(25)=0.459$, p=0.021

The graph below shows the correlation coefficients (where magnitude is the effect size) for these time-lag data.