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Effect of income on trust: evidence from the 2009 economic crisis in Russia

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Summary
This paper draws on a natural experiment to identify the relationship between income and trust. We use a unique panel dataset on Russia where GDP experienced an 8 per cent drop in 2009. The effect of the crisis had been uneven among Russian regions because of their differences in industrial structure inherited from the Soviet period. After instrumenting average regional income by Soviet industrial structure, we find that a 10 per cent decrease in income is associated with a 5 percentage point decrease in social trust. We also find that post-crisis economic recovery did not fully restore trust to its pre-crisis level.

Keywords: Economic crisis, regional income, social trust.

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1 Introduction

In 1958, American sociologist Edward C. Banfield identified a set of norms and beliefs that held back the southern Italian village of Montegrano(Banfield, 1967). According to Banfield, Montegrano residents were so deeply suspicious towards each other that any collective project became impossible and any attempt to foster civic life would be futile. The villagers, Banfield argued, were operating under assumptions that all their neighbours were maximising "short-term advantages" of their nuclear families. In this environment, any cooperation was impeded by people's fear of being taken advantage of. In other words, society was held back by the lack of social trust.[1]

Since then, trust has become one of the most important concepts in social science. Using country-level and state-level data, scholars have argued that trust substantively contributes to economic growth and development (Knack and Keefer, 1997; Zak and Knack, 2001; Knack, 2003; Dincer and Uslaner, 2010; Algan and Cahuc, 2010; Bjørnskov, 2012; Algan and Cahuc, 2013). Scholars have also argued that trust plays a key role in a variety of important outcomes: financial development (Guiso et al., 2004; Karlan, 2005), political participation (DiPasquale and Glaeser, 1999; Satyanath et al., 2013), voting for populist politicians (Algan et al., 2017), efficiency of the judiciary system (La Porta et al., 1997), political accountability (Nannicini et al., 2013), labour market institutions (Algan and Cahuc, 2009), internal organisation of firms (Bloom et al., 2012), international investment (Massa et al., 2015), wealth and health (Hamilton et al., 2016), resilience to adverse events (Helliwell et al., 2016), ability of firms to obtain loans (Allen et al., 2005; Levine et al., 2016), and individual earnings (Butler et al., 2016b).

Given the importance of trust for economic growth and various aspects of economic and political life, it is important to understand what determines the level of trust in the first place. Banfield's original work offered several explanations of the lack of trust in Montegrano, but his first choice was the low standard of living. Montegrano was a poor village where 80 per cent of households lived off subsistence farming. A threat of hunger was imminent. Banfield argued that the constant focus on survival led to what he called "amoral familism", or the lack of willingness to cooperate with other villagers outside the nuclear family. Banfield named poverty as the first determinant of the lack of trust: "The dreadful poverty of the region and the degraded status of those who do manual labor ... are surely of very great importance in forming it [amoral familism]" (Banfield, 1967, p. 139).[2]

The cross-sectional evidence from the literature suggests that at both the individual level and at the state level trust is indeed associated with higher income (see, among others, Alesina and La Ferrara, 2002 and Algan and Cahuc, 2013). However, establishing a causal relationship between income and trust is difficult as this requires identifying an episode where both income

[1] Pew Research Center (Taylor et al., 2007) defines social trust as "belief in honesty, integrity, and reliability of others". Other scholars sometimes use the term "generalised trust" to denote the same phenomenon (Bjørnskov, 2007; Prize et al., 2016). Our paper uses the terms "social trust", "generalised trust", and "trust" interchangeably.

[2] Banfield then discussed three other factors contributing to the "amoral familism": likely premature death, inefficient land tenure institutions, and the underdeveloped institution of the extended family. However, in the beginning of the Chapter 8 "Origins of the Ethos" he emphasised that the discussion of three other elements "is not to depreciate the importance" of the poverty and the degraded status.

and trust change substantially and where the change in income can be instrumented by a factor that does not affect trust directly.

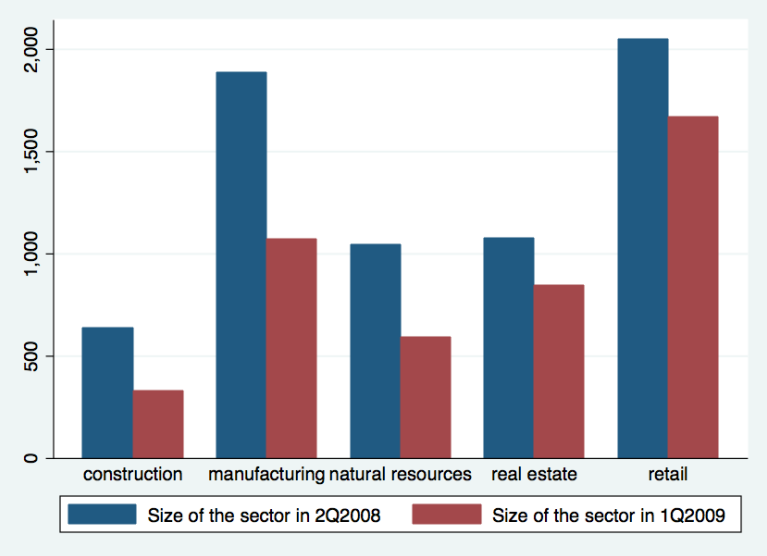
In this paper, we consider a natural experiment that helps to identify the impact of negative income shocks on trust. We use a large regionally representative survey administered to 34,000 Russians in the second quarter of 2008 and in the first quarter of 2009, before and after the main shock of the 2008-09 crisis. During this crisis, Russia experienced an acute drop in income; in 2009, Russian GDP contracted by 8 per cent – the largest decline among G20 countries. The fall in GDP in the fourth quarter of 2008 and the first quarter of 2009 was 19 per cent and 17 per cent in annual terms (constant prices, seasonally adjusted). The Russian stock market peaked exactly in the second quarter of 2008 (the dollar-denominated RTS Index reached the all-time high of 2,488 on 19 May 2008; this record has never been broken afterwards). Respectively, in the first quarter of 2009 the Russian market bottomed out: on 23 Jan 2009 the RTS Index traded at only 498, just at 20 per cent of its value at its peak. The average value of the RTS Index in the second quarter of 2008 was 2,277, the average value in the first quarter of 2009 was only 592, or 74 per cent lower.

Most importantly, the effect of the crisis was very uneven across Russia. If we ranked Russian regions by their real GDP per capita growth in 2009, the top quartile would grow by 1 per cent, while the bottom quartile would decline by 20 per cent. The heterogeneity of the response to the crisis was at least partially explained by the different compositions of the regional economies. As in every recession, the decrease in investment is substantially larger than that in consumption, hence the regions that were more dependent on capital-goods-producing industries, and manufacturing in general, suffered the most. At the same time, the regions specialising in consumer goods and services experienced only a moderate GDP fall or even continued to grow.

Figure 1 shows the output decline in the five largest sectors of Russian economy (that is, retail, construction, natural resources, manufacturing and real estate) between the second quarter of 2008 (the last pre-crisis quarter) and the first quarter of 2009 (the lowest point of the cycle). The largest decline took place in manufacturing and in natural resources with both shrinking by more than 40 per cent from the second quarter of 2008 to the first quarter of 2009. The 2008-09 crisis was accompanied by a deep fall in the world prices for natural resources; in particular, the price for oil, the main Russian export commodity, went down by a factor of three from peak (also, in the second quarter of 2008) to trough (in the first quarter of 2009).

Russia's regions vary greatly in terms of the composition of regional GDP: in 9 out of 66 regions in our sample the share of manufacturing in GDP is below 10 per cent, while in two regions the share of manufacturing is more than 50 per cent. The variation is inherited from Soviet industrialisation and is plausibly exogenous to the events of 2008-09. This allows us to construct an instrument for the potential impact of crisis on income. We use the data on the composition of the Soviet economy compiled by Brown et al. (1993) from the last Soviet industrial census of 1989. For each region of Russia, we use the share of employment in 1989 in (i) production of industrial machinery and equipment (SIC code 35); (ii) metal products (SIC code 33); and (iii) oil and gas (SIC code 13). A high share of employment in the first two sectors in 1989 is a good predictor of the share of manufacturing and capital-goods-producing industries in 2008. Similarly, the share of employment in oil and gas in 1989 is a good predictor

Figure 1: Output of the largest sectors of the Russian economy in the second quarter of 2008 and in the first quarter of 2009 in billions of 2008 roubles



Source: Rosstat, Bank of Russia.
Note: Average exchange rate in this period was 26 roubles per U.S. dollar.

of oil and gas output in 2008. The Soviet industrial structure turns out to be a strong instrument for the change in income between the middle of 2008 and the beginning of 2009: the first-stage F-statistic is above 10, and the bias of 2SLS is safely below 15% of OLS estimation, according to Stock-Yogo critical values for weak identification (Stock and Yogo, 2002).[3]

After instrumenting the change in regional income with the Soviet employment in manufacturing and oil and gas, we find that the effect of change in income on change in trust is statistically significant and large in magnitude. Controlling for other conventional determinants of trust, we show that a 10 per cent decrease in income is associated with a 5 percentage point decrease in the share of respondents who say that most people can be trusted. For Russia, it is a large effect: indeed, the average level of trust in our data is 34 per cent in 2008 and 19 per cent in 2009.

Our results are not driven by pre-existing trends. We study the evolution of trust before the crisis and show that regions with different economic structures had similar changes in trust. Another concern with our identification strategy is that the Soviet industrial structure may have affected trust through other channels. Indeed, the regions historically specialising in capital goods and oil production may differ from other regions in terms of trust.

There are two reasons, however, why this concern does not undermine our results. First, the historical differences should affect the level of trust rather than its change within one year during the crisis. We do check if the level of trust is correlated with the Soviet industrial structure and find the three instruments together explain less than 3 per cent of variation in the level of trust in

[3] All estimations, unless specified otherwise, have been done in ®Stata using *ivreg2* package (Baum et al., 2007).

2005, 2008 or 2009. Second, even if the Soviet industrial structure affected the *change* in trust during the crisis through other channels, this relationship would work in the opposite direction. Indeed, the regions with procyclical economies should have become more – rather than less – resilient to economic volatility. Therefore this would only strengthen our findings.

In order to understand the persistence of the destruction of trust during the 2009 crisis, we commissioned another survey of the same sample of regions in April 2014. By that time, the Russian economy had recovered from the 2009 shock; Russia's GDP even exceeded the pre-crisis level. We found that in the regions where trust declined moderately during the 2009 crisis, trust reached and even exceeded the pre-crisis levels (by 1.5 percentage points). However, in the regions where the 2009 shock resulted in a large decline in trust, the impact of the shock still persisted in 2014. In the latter regions, trust in 2014 was 10 percentage points below the pre-crisis levels. Our evidence therefore suggests that large shocks to trust may have long-lasting effects.

The rest of the paper is structured as follows. Section 2 offers a brief overview of the literature. Section 3 provides a background on the Russian crisis of 2008-09 that motivates our choice of instruments. In section 4 we discuss hypotheses, econometric specifications and data; we also outline identifying assumptions necessary for our research design and explore their plausibility – in particular, we look at the exclusion restriction of our instrumental variables. In section 5 we report the main results. We show that the effect of income on trust is both statistically and economically significant; we also investigate the channels through which income may affect trust. In section 6 we discuss alternative explanations, carry out placebo tests and robustness checks. In section 7 we explore the external validity of our results by showing that large changes in income and trust during the crisis are also observed in other countries. We find that the cross-country evidence from the Life in Transition Survey (covering 35 eastern and western European countries) is consistent with our results. In section 8 we study the evolution of trust in Russian regions after the crisis. Section 9 concludes.

2 Literature

In this paper we are testing the effect of negative income shocks on trust. There may be at least two reasons to believe that such a causal relationship exists. First, higher incomes may lead to higher trust because better-off individuals feel more secure economically and are less averse to risk. Since trusting other people may bring both positive and negative returns, depending on how the counterpart reciprocates, lower risk aversion may contribute to higher propensity to trust others. This view is consistent with Dohmen et al. (2012) who show that willingness to take risk and to trust others is positively correlated, even controlling for parents' attitudes to risk and trust. It is also consistent with Uslaner (2013) who shows that trusting individuals are less worried about crime risks controlling for objective level of crime, news coverage of crime and personal victimisation experience.

Second, higher incomes may lead to higher trust because individuals use income as an observable statistic to infer the degree of fairness of the world around them (and therefore the returns to trusting others). This is consistent with a seminal paper by Piketty (1995) who studies the effect of the learning from past income experiences on the preferences for redistribution and therefore social mobility in equilibrium. Suppose that an individual's income depends on both her own contribution and on that of the rest of the world; and that the individual cannot directly observe her own productivity. Then individuals who observe higher income attach a higher probability to the scenario that the others are fair towards them. This view is also consistent with Butler et al. (2016a) who show that, in the context of a trust game, people feel cheated when a negative return on their investment is realised.

Our paper also contributes to the literature on the long-run impact of recessions on employment (Blanchard and Summers, 1986; Røed, 1996, 1997). In particular, our paper provides evidence on a channel through which this effect might operate: recessions destroy trust that is needed for productive cooperation. Our results are consistent with Giuliano and Spilimbergo (2013) who show that people facing recessions and macroeconomic disasters in their formative years have distinctly different beliefs – supporting government redistribution and voting for left-wing parties. Our results are also consistent with Fisman et al. (2013) who show in a laboratory setting that people who experience losses are more likely to behave selfishly.

We demonstrate that trust can change quickly in response to economic shocks, and that the implications of those shocks are persistent. This conclusion is new since most of the scholarship on this topic emphasises deep historical roots of norms, attitudes and values. Following Putnam et al. (1993), who famously attributed poor quality of government in the southern Italy to the legacy of the late-medieval autocratic Norman regime, authors demonstrate that norms and values today are influenced by the legacies of the colonial era (Nunn and Wantchekon, 2011), the Black Death in Europe (Voigtländer and Voth, 2012), Pale of Settlement in Imperial Russia (Grosfeld et al., 2013), communism in eastern Europe (Alesina and Fuchs-Schündeln, 2007; Pop-Eleches and Tucker, 2011), and the Hindu caste system (Hoff et al., 2011); see also a detailed survey in (Fuchs-Schuendeln and Hassan, 2015). Scholars have also argued that the scope of trust might depend on the pre-modern family structures (Moscona et al., 2017) and pre-modern political institutions (Guiso et al., 2016).

These studies have rather pessimistic policy implications. If the stock of trust in a society is determined by long-term history, then the policy-makers' ability to build trust is limited. While we do not disagree with those results, our analysis suggests that trust does have a substantial malleable component that can be influenced by economic policies. For example, if during an economic crisis the government implements a generous counter-cyclical fiscal policy, it may be able to prevent the destruction of trust and thus preclude the long-lasting negative effects of economic shocks.[4] In this sense, our paper is directly related to the distinction between "Putnam I" versus "Putnam II". As discussed by Algan and Cahuc (2013), "Putnam I" (following Putnam et al. (1993)) states that trust is very stable over time, and is to a large extent determined by history, while "Putnam II" (after Putnam (2001)) argues that trust can change substantially in a shorter period of time. While these views do not need to contradict each other, our study can be interpreted as an attempt to quantify the magnitude of "Putnam II", as we show that trust does respond to economic shocks very quickly and estimate this effect.

Our paper is also related to the literature on social capital. Social capital is a broad concept that includes norms, beliefs and networks that facilitate cooperation. Because trust is supposed to be a crucial part of social capital, our study can be seen as an exploration into the roots of creation and destruction of social capital. We remain agnostic, though, to the question of whether "social capital" is a more useful concept than any of its parts (like political participation, or trust). Some scholars have used the concept of social capital to explain social, economic and political outcomes (Coleman, 1988; Putnam et al., 1993; Putnam, 2001). It is also worth pointing out, however, that it has been demonstrated in a seminal contribution by Uslaner (2002) that social capital consists of many components that might be orthogonal to each other; Bjørnskov and Sønderskov (2013) carefully work through all the definitions of social capital and conclude that the concept has little added value over its parts.

Another strand of literature which is relevant for our paper is a literature that looks at the relationship between various types of trust and economic shocks. Specifically, Stevenson and Wolfers (2011) find a relationship between trust in government and financial institutions, and economic shocks during the recent crisis in the United States and show that state-level economic shocks do result in lower trust in institutions. Papaioannou (2013) and Guiso et al. (2015) find similar results in Europe. Papaioannou (2013) shows that during a recent crisis in Europe both generalised social trust and trust in institutions declined; the decline was especially large in countries that had greater economic losses during the crisis. Our contribution to this literature is that we construct an instrument for economic shocks and therefore identify the causal relationship between income and trust.

We also offer a new way to identify a causal relationship between economic growth and trust. While the idea to use the structure of the regional economy to predict the impact of recessions dates back at least to Bartik (1991) and Blanchard et al. (1992), our paper is the first one to use it as an instrument for studying the evolution of trust.[5] Most of the literature on the relationship between trust and growth is based on cross-sectional OLS regressions and therefore cannot

[4] It is also important that those policies are broad-based, as, according to Rothstein and Uslaner (2005), means-tested policies destroy trust through stigmatising their recipients.

[5] Recent work based on Bartik instruments (for example, Diamond, 2016) uses all data on employment structure for all 3-digit SIC industries for 286 US cities. Given that our dataset is limited to 66 Russian regions, we only choose three industries that economic theory predicts to matter for the impact of the 2009 crisis.

overcome the issue of causality. As both growth and trust depend on a multitude of social and political characteristics, it is very hard to find a convincing instrument.[6] For instance, Miguel et al. (2005) use panel data to study the relationship between industrialisation and social networks in Indonesia. They also acknowledge that their empirical strategy cannot identify causal effects and/or determine the direction of causality. A notable exception in this literature is Algan and Cahuc (2010) who use the data on the origin of immigrants coming to the United States and timing of their families' arrival to the United States. Similarly to the previous studies (Rice and Feldman, 1997; Putnam, 2001; Guiso et al., 2006), Algan and Cahuc (2010) find that the trust among the US immigrants is correlated with the trust in their home countries and therefore can be used as an instrument for the inherited trust in their countries of origin. They show that inherited trust explains a large part of variation in economic growth in 48 countries. Our paper also uses the instrumental variable approach but we consider the opposite question – whether economic performance influences trust.

[6] See Durlauf (2002); Durlauf and Fafchamps (2005); Blume et al. (2011) on the methodological challenges in the econometric research on social capital.

3 Background: spatial dimension of the 2008-09 crisis in Russia

In this paper we view the global economic crisis of 2008 and 2009 as a "natural experiment" that helps us identify the effect of income on trust. While there are many explanations of the crisis's causes, for the purpose of this study we only need to assume that the crisis was global, and that the crisis did not originate in Russia.

During the crisis, GDP of the advanced economies declined by 3 per cent in 2009; according to the International Monetary Fund's World Economic Outlook Database, this was the only year since 1980 when advanced economies had a negative GDP growth. Major stock market indices plummeted nearly by half from peak to trough.

In Russia, the problems were much more acute than in the other large economies. Annual GDP went down by 8 per cent in 2009, constituting the largest decline in the G20. The shock was not only huge, but sudden: Russian authorities, the general public and the business community were caught by surprise. Treisman (2012, p. 148) reports that, according to the Renaissance Capital (the second largest Russian investment bank), in August 2008 "Moscow was flooded with international bankers competing to provide money to Russian entities". In October, "the only financiers visiting were those trying to get their money back". According to the World Bank, net inflow of foreign direct investment in Russia fell by a factor of two: from US$ 75 billion in 2008 to US$ 36.5 billion in 2009.[7] The dollar-denominated RTS Index of the Russian stock market fell by 80 per cent (peak to trough).

The fact that Russia was caught by surprise explains why the shock of the crisis was not initially mitigated by policy response. The first anti-crisis plan was adopted by the Russian government only on 9 April 2009.

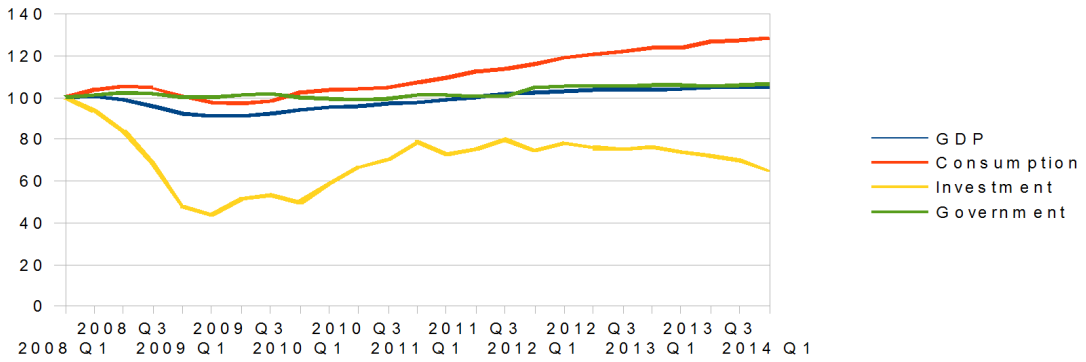
The large, unexpected and unmitigated collapse of the Russian economy creates a quasi-experimental setting for the analysis of impact of income on trust. Our data on generalised trust come from two surveys administered right at the pre-crisis peak of the second quarter of 2008 and at the bottom of the crisis in the first quarter of 2009.

The basic macroeconomics of the business cycle imply that recessions hurt investment more than consumption. Investment is typically pro-cyclical and the most volatile part of GDP. As shown in Figure 2, aggregate consumption dropped by 3 per cent in the first quarter of 2009 compared with the second quarter of 2008, while aggregate investment dropped by 50 per cent during the same period (both in constant prices, seasonally adjusted).

In addition to the fall in demand for investment, the global crisis brought down oil prices. According to the US Department of Energy, the average oil price in Europe in the second quarter of 2008 was US$ 121 per barrel (this maximum has never been observed, either before or after). The oil price then fell to US$ 44 per barrel in the first quarter of 2009 (its lowest level

[7] http://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD .

Figure 2: Russia's GDP, consumption, investment, and government spending in 2008-2014



Source: Official data (Rosstat).
Note: Constant prices, seasonally adjusted, normalised to 100 in the first quarter of 2008.

in 2005-2014) and recovered afterwards.

The crisis therefore had a very different impact on different Russian regions. Figure 3 shows the differences between the regional GDP per capita in 2008 and in 2009. The regions with the biggest drop in GDP are mostly in the central and western parts of Russia (Vologodskaya Oblast, Samarskaya Oblast, Bashkortostan, Chelyabinskaya Oblast, Lipetskaya Oblast), while the regions in the far eastern part of Russia (Primorskii Krai, Sakhalinkskaya Oblast, Kamchatskii Krai) did not suffer as much or even experienced economic growth. However, regions hit by the crisis are present in all parts of Russia.

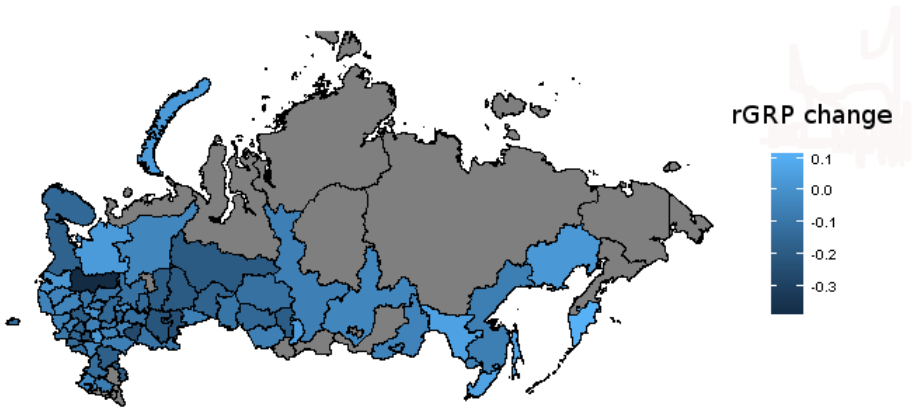
Most importantly, the crisis hurt especially strongly those regions that were dependent on capital goods and oil. In Russia, industries are heavily concentrated. In more than 20 Russian regions a single industry accounts for more than 40 per cent of industrial production.[8] For example, ferrous metallurgy constitutes 70 per cent of manufacturing of Lipetskaya Oblast (region in western Russia with 1.5 million people) and 65 per cent of Chelyabinkaya Oblast (region in the Urals with nearly 4 million people). Overall, in an average Russian region the share of the top industry in the total industrial output is 29.3 per cent.

The geographical concentration of industry is inherited from Soviet times. The location of Russia's main industrial assets still reflects the decisions made by the Soviet leadership many decades ago. For example, Lipetskaya Oblast is dependent on the production of steel because of Novolipetsk Steel – the third largest steel plant in Russia. This plant was built in 1934. One of the main industrial assets of Chelyabinskaya Oblast is Magnitogorsk Iron and Steel Works, which was founded in 1926.

Path dependence of economic activity is a widely recognised phenomenon: Krugman (1991) points out that today's concentration of manufacturing in the United States reflects early colonial

[8]Natalya Zubarevich, "Evaluation of Impact of Crisis on Russian Regions", Independent Institute of Social Policy, February 2009. http://www.cscp.ru/content/16/10944/

Figure 3: Change in real regional GDP per capita between 2008 and 2009



Source: Rosstat.
Note: The map plots the differences between real per capita regional gross domestic product between 2008 and 2009. The darker areas correspond to the largest drops in regional GDP per capita. The grey areas are the regions for which the data on the change in trust are not available. These regions are excluded from our analysis; they account for about 10 per cent of the Russian population.

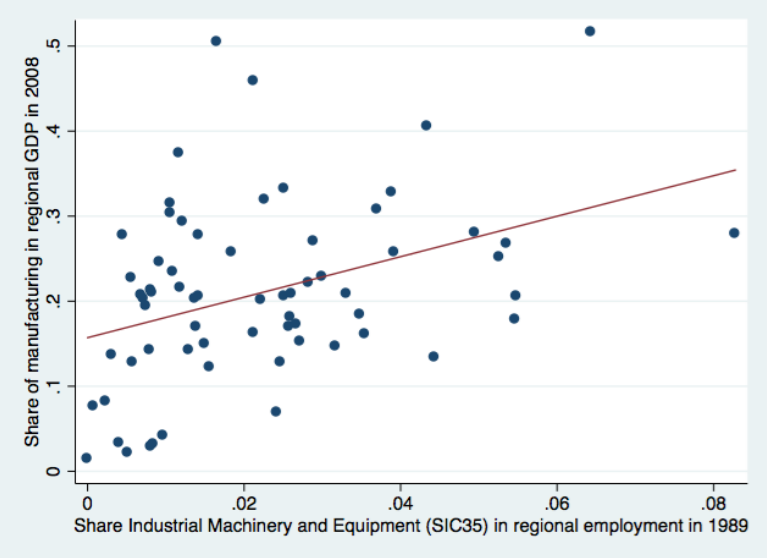
agricultural settlements in the north east. As for Soviet regional development, Mikhailova (2012) shows that Stalin's industrial policy had long-lasting effects on the growth of Russian cities. Cities that had labour camps established by GULAG (Stalin's Main Administration of Corrective Labour Camps and Labour Settlements) within a 50 km distance, grew faster than the cities with the similar observable characteristics. The difference in population persists until 2010, and the effect is larger for the GULAG camps that specialised in building industrial infrastructure than for the camps that specialised in agriculture and forestry. This evidence strongly suggests that the geographical structure of the Russian economy is to a large extent pre-determined by its Soviet heritage and is exogenous to the change in trust between 2008 and 2009. This exogeneity allows us to identify the causal effects of income on trust.

Our instrument is based on the data on the composition of industrial employment in 1989 (see Brown et al. (1993)). These data come from the 1989 Census of Soviet Manufacturers, the last enterprise census carried out in the command economy before transition began. This census has two important advantages. First, the existing institutions of central planning still provided high reliability of the data. Second, the census pre-dated transition to a market economy and the disintegration of the eastern bloc and the Soviet Union hence being exogenous to market forces. Following Brown et al. (1993), we do not rely on Soviet prices; we use the data on employment structure rather than on composition of rouble sales.

Using the 1989 survey of industrial enterprises, for each region of Russia, we calculate soviet

capital goods employment as this region's shares of employment in industries with Standard Industrial Classification 13, 33 and 35 ("oil and gas", "primary metal industries" and "industrial machinery and equipment", respectively) in 1989.[9] According to the data, the share of primary metals in overall regional employment was 0.9 per cent (the maximum among the regions was 7.2 per cent); the share of employment in machinery and equipment was 2.2 per cent (the maximum among the regions was 8.3 per cent); the share of employment in oil and gas was 0.2 per cent (the maximum among the regions was 3.3 per cent).

Figure 4: Employment share in industrial machinery and equipment in 1989 and the share of manufacturing in regional GDP in 2008



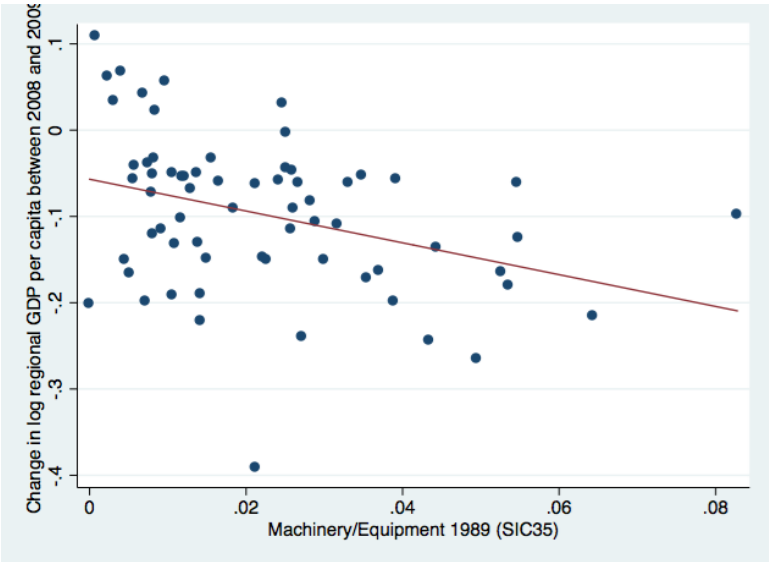
Sources: 1989 Soviet Industrial Census, Rosstat.

Soviet-time employment shares turn out to be a strong predictor of today's economic structure. In particular, the relationship between the share of employment in industrial machinery and equipment in 1989 and the share of manufacturing in regional GDP in 2008 is positive and statistically and economically significant (see Figure 4). One percentage point change in the employment in industrial machinery and equipment in 1989 corresponds to 2.4 percentage points in the share of manufacturing in regional GDP in 2008.

Following the logic above, Soviet industrial employment is also correlated with the *change* in income during the crisis. For example, Figure 5 shows the plot of change in the regional per capita GDP between 2008 and 2009 and the share of employment in industrial machinery and equipment in 1989. One percentage point deviation in the share of employment in machinery and equipment corresponds to 1.3 per cent of decrease in income during the crisis; for primary metal products the respective number is 2.6 per cent; for oil and gas it is 4.0 per cent.

[9] In section 6 we also run regressions using just two out of the three instruments.

Figure 5: Machinery and equipment in 1989 and change in regional per capita GDP from 2008 to 2009.



Sources: 1989 Soviet Industrial Census, Rosstat.

4 Empirical strategy

4.1 Hypotheses and specification

Our identification strategy is designed to test a causal notion that more people in a society start to distrust each other as their incomes go down. If this claim is true, the data should reject the null hypothesis about the absence of any statistical association between income and trust:

> HYPOTHESIS H0. *Change in trust from 2008 to 2009 does not differ between the regions with different predicted change in income.*

In order to test the hypothesis we need to estimate a structural equation of the following form:

$$\Delta Trust_i = \alpha + \beta \Delta Income_i + \sum_k \gamma_k \Delta X_{ki} + \epsilon_i \quad (1)$$

Here, $Trust$ is an average level of trust in the region i at period t, $\Delta Trust_i$ is the change in $Trust$ from the second quarter of 2008 to the first quarter of 2009, $\Delta Income_i$ is the respective change in log regional income between 2008 and 2009, ΔX_{ki} are the changes (between 2008 and 2009) in the other correlates of trust established in the literature: average age (Mishler and Rose (2001)), public goods, higher education (Kumlin and Rothstein (2005)), inequality (Knack and Keefer (1997)). To reject *H0*, the coefficient at $\Delta Income$ must be large in magnitude and significantly different from zero.

As $Income$ is an endogenous variable, we use the 2SLS procedure with the first stage as follows:

$$\Delta Income_i = \kappa + \lambda SovietIndustrialStructure_i + \sum_k \mu_k \Delta X_{ki} + u_i \quad (2)$$

Here $SovietIndustrialStructure_i$ are the values of the instruments introduced in section 3.[10] Because our main dependent and explanatory variables are the differences in trust and in incomes, we do not expect spatial correlation in error terms driven by the geographical positions of our units of analysis.

4.2 Data

Our data come from two sources: the Public Opinion Foundation (Fond Obschestvennogo Mneniya, or FOM) and the Russian State Statistics Agency (Rosstat). FOM conducts large

[10] In order to test the validity of our approach we will also check that our results are not driven by pre-existing trends (the parallel trends and placebo analyses are provided in section 4.3 and section 6.1, respectively). Also, one might consider using a full battery of the shares of all industries in 1989. We explore this approach in section 14 of the Online Appendix.

regionally representatives GeoRating Surveys repeated quarterly since 2003. Nearly 34,000 randomly selected Russian households in 66 regions (where 90 per cent of the Russian population lives) are surveyed about their economic conditions and expectations, political positions, opinions on current events, and demographic characteristics.

FOM selects respondents using a three-step stratified sample. In the first step, districts are selected to ensure geographical representation (for example, the shares of urban and rural population in the sample are chosen to match the population). In the second step, the settlements are selected randomly with the probability of each settlement to be selected equal to the share of population living there. In the third step, households are selected using random walk procedure. A respondent within a household is selected using gender, age and educational quotas calculated from the national census.

Trust is measured by the response to question *"Generally speaking, do you believe that most people can be trusted or that you can't be too careful in dealing with people?"*. This question is a standard measure of trust used in the US General Social Survey and World Values Survey. Despite its high prominence in the empirical studies, scholars have argued about its interpretation. According to one of the views, trust is a probability that a person will be behave cooperatively (Gambetta, 2000). In an experimental setting, scholars have found that the standard question is correlated with the behavioural measures of trustworthiness[11] (Glaeser et al., 2000; Lazzarini et al., 2005) or behavioural measures of trust (Fehr et al., 2003), depending on the experimental design and subject pool.

Another interpretation of this question is that the respondents interpret it as a fundamental belief that the others share their moral values (Uslaner, 2012). This assessment may or may not coincide with the previous, experience-based, assessment. For our empirical exercise, both interpretations are relevant, because both of them promote cooperation and thus lead to beneficial economic and political outcomes. The difference between the two interpretations, though, becomes relevant in our subsample analysis where we attempt to disentangle the mechanisms of the effect. We offer this discussion in section 5.2.

This question was asked twice: the first time in the second quarter of 2008, and the second time in the first quarter of 2009. So, our time dimension includes just two periods. While the regions of the survey were the same both times, the households were different. So, for every region we divide respondents into three locations: regional centre (for example, Lipetsk in Lipetsk region), non-centre urban area (for example, all the cities and towns in Lipetsk region except for Lipetsk itself), and rural area (all the villages). For each of these locations we calculate average values of the variables of interest from the individual responses. Income is measured by the regional GDP per capita deflated by the regional consumer price index.[12] In the robustness checks we also use nominal GDP per capita and real GDP deflated by GDP deflators; the results are similar.

[11] Trustworthiness is usually operationalised as a receiver's behaviour in a trust game (Berg et al., 1995), while trust is operationalised as the sender's behaviour.

[12] The survey includes a question about personal income as well: *"Declare, please, at least approximately, your income in the last month per family member."* The respondents are instructed to report their income in one of 15 pre-defined intervals. These intervals are, however, very broad: the average difference between lower and upper bounds of the intervals is 26 per cent. These data are therefore not suited for measuring change of income over time. In section 11 in the Online Appendix we use them for cross-sectional regressions.

Since our instrument and the income variable are measured at the regional level, we always cluster standard errors at the regional level as well. Neither the magnitude nor the statistical significance of the effect of income of trust would change if we aggregated trust at the regional level and ran a regression with 66 observations.

Data on the respondents' age and level of education also come from FOM surveys. Data on inequality and homicide rates come from Rosstat (and are also therefore at the regional level). Section 1 in the Online Appendix presents the descriptive statistics of the variables for both years.

4.3 Identifying assumptions and their plausibility

Our research design combines two strategies: instrumental variables and difference-in-differences. Therefore, in order to identify the causal effect of income on trust, we need to satisfy several assumptions. In this section, we discuss these assumptions, test those assumptions that can be tested, and provide evidence on the plausibility of those assumptions that cannot be tested directly. In particular, our difference-in-differences strategy requires that the "treated" units should have the same counterfactual trend of trust than "non-treated" units. This assumption is not testable, but it is possible to test a weaker assumption – that the pre-treatment trends are parallel. As usual, instrumental variable estimation relies on relevance, excludability, and monotonicity of the instruments.

> ASSUMPTION 1 ("Parallel trends"). *Pre-crisis trends of trust for the localities vulnerable to the crisis are not different from the trends for the localities not vulnerable to the crisis.*

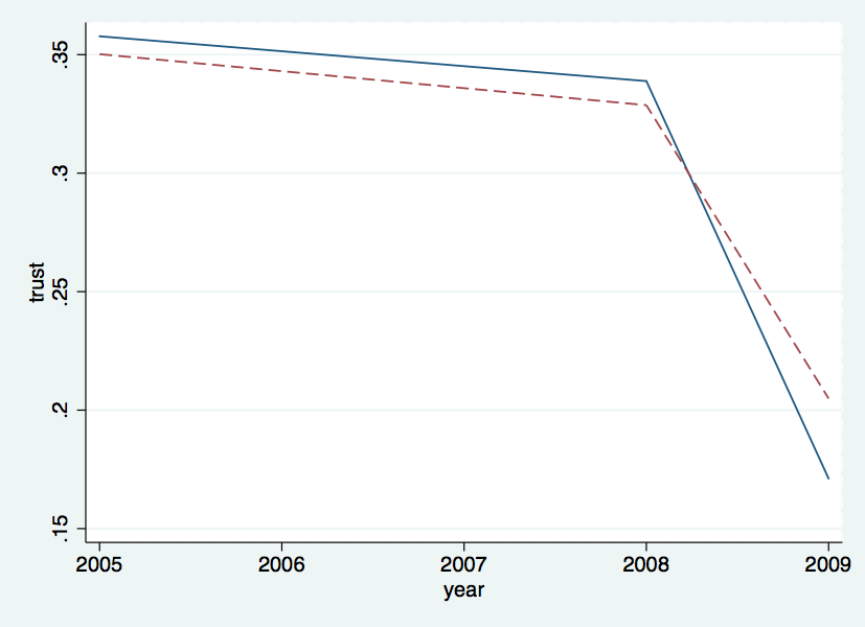
In order to ensure that an estimation based on a cross-section of differences identifies a causal effect, we test whether our result (the correlation between decline in income and decline in trust) is not an artefact of different pre-treatment trends in these two variables. To check this, we use yet another GeoRating survey by FOM. In 2005, the survey included a question on trust that had the same wording and similar place among other questions as the trust questions in 2008 and in 2009. While FOM acknowledges certain problems with the quality of these data,[13] these problems are unlikely to bias the results of parallel trends estimation at the regional level. The average trust level in 2005 is similar to the one in 2008: 36 per cent and 34 per cent, respectively.

To check whether the trends are parallel before 2008, we compare the evolution of trust in 2005-08 in the regions with high, intermediate and low vulnerability to the crisis. Using the three instruments based on the Soviet industrial structure, we calculate the predicted income

[13] In an email to Sergei Guriev, FOM Managing Director, Alexei Churikov wrote that, in 2005, the weighting formula included not only regional populations, but also the self-reported voter turnout in a region. Because we use aggregated data and not individual-level data, thus ignoring the weighting (whether it is correct or not), these problems appear inconsequential for our estimation. In 2007, FOM conducted another survey that included a question on trust. However, it allowed for fewer response categories which makes results not directly comparable with those of 2005, 2008, 2009 and 2014.

change in 2009 for each region. Then we split the distribution of regions into three terciles. The first tercile includes the regions with the predicted income change from -30.2 to -9.7 per cent — these are the regions which are most vulnerable to crisis. The second tercile includes the regions with the predicted income change from -9.5 to -7.0 per cent. The third tercile includes the least vulnerable regions (predicted income change from -6.9 to -3.6 per cent). We plot average trust levels for the bottom and top terciles in 2005, 2008 and 2009 in Figure 6. The graph shows that the parallel trends assumption holds: the change between 2005 and 2008 was similar across terciles (-1.9, -2.6, and -2.2 percentage points for the first, second, and third terciles, respectively). Consistent with our theoretical predictions, the picture looks very different for the changes between 2008 and 2009: trust declined by -16.8 percentage points in the first tercile, by -14.6 in the second tercile, and only by -12.4 in the third tercile. In other words, during the crisis trust declines in all the terciles; however, the decline is much larger in the regions from the first tercile (the regions with the largest predicted fall in income in 2009). This difference in the degree of decline of trust during the crisis is even more striking given that before the crisis the evolution of trust in the three terciles was similar.

Figure 6: Evolution of trust in the regions classified by the predicted income change in 2009



Source: FOM surveys, 1989 Soviet Industrial Census, Rosstat.
Note: The solid line represents the first tercile (largest predicted fall of income in 2009) and the dotted line represents the third tercile (smallest predicted fall of income in 2009).

Results are robust to replacing terciles with other quantiles. We also perform econometric tests of this relationship and report their results in section 6.1.

ASSUMPTION 2 ("Relevance"). *Instrumental variables (Soviet industrial employment in 1989) are strongly correlated with the treatment variable (the drop in real GDP per capita between 2008 and 2009.)*

The validity of instrumental variable estimation relies on instruments being strongly correlated with the treatment variable. To test this assumption, in Table 4 we present F-statistics for excluded instruments for the first stage. The F-statistic varies from 10.9 to 18.8, depending on the set of covariates. In our preferred specification, it is 18.8, implying that the weak instruments problem should not be a concern in our case.

> ASSUMPTION 3 ("Excludability"). *Soviet industrial structure in 1989 influences the change in trust between 2008 and 2009 only through its influence on the change in GDP per capita.*

The results of instrumental variable estimations are only valid if an instrument influences an outcome through treatment only, rather than directly or through other means. This assumption cannot be tested directly. Nevertheless, we can offer several pieces of evidence that support the plausibility of this assumption in our case.

Our dependent variable is a within-unit difference in trust between two periods. Our treatment variable is also a within-unit difference between the very same two periods (and parallel trends are ruled out). Therefore, in order to violate excludability, our instrument – the Soviet industrial structure in 1989 – should influence the *changes* in trust between 2008 and 2009, not the levels of trust.

Following Blanchard et al. (1992) and Miguel et al. (2005), one can expect that the instrument can affect changes in trust through inter-regional mobility. If people who leave the region because of the crisis have better social networks and are more likely to be socialised into values of cooperation, then the average trust in the region will go down, but this process will not be representative of changing attitudes on the individual level.

In our setting, this mechanism is unlikely to be empirically important. We are looking at a very short period of time (our 2008 and 2009 surveys were held only within three quarters from each other). The inter-regional migration rates in Russia in those years are also quite low: 0.5 per cent - 0.6 per cent of the population (Guriev and Vakulenko, 2015). Therefore mobility can explain at most a fraction of a percentage point of change in trust which is negligible relative to the total change in trust during the crisis.

One way to provide suggestive evidence of the validity of our instruments is to examine the differences in covariates between regions with the different levels of vulnerability to crisis. Table 1 presents the differences in per capita GDP, education, age, inequality, and homicide rates by terciles of predicted income change during the crisis (to make it comparable to our parallel trends analysis above). The results are similar for other choices of quantiles.

If the influence of the instrument is on average mediated by some of the observable variables, we should find the differences in the observables that are potential mediators. We do not find any significant differences between the regions with different levels of vulnerability to crisis. Of course, this does not rule out mediation through *unobserved* confounders, so we should look more closely to some of the potential causal pathways.

Table 1: Pre-crisis observable characteristics of localities in 2008

	1st Tercile	2nd Tercile	3rd Tercile
GDP per capita	211.5	172.5	186.1
	(164.9)	(914.4)	(117.8)
Homicides	17.9	17.68	22.7
	(8.51)	(9.49)	(13.77)
Gini	0.40	0.40	0.39
	(0.03)	(0.03)	(0.02)
Age	45.08	45.28	44.28
	(1.93)	(1.85)	(1.98)
Education	0.13	0.15	0.17
	(0.07)	(0.08)	(0.09)

Sources: FOM surveys, Rosstat.
Note: The data are presented by terciles of predicted income change in 2009; the first tercile includes the regions with the largest predicted fall in income in 2009. Regional GDP per capita (in thousand roubles) is from the Russian State Statistics Agency (Rosstat). Gini and homicide rates are also taken from Rosstat. Individual characteristics (Education and Age) are calculated using the survey responses averaged out at the level of location: regional centre, non-centre urban area, and rural area in a region. Education is a share of people with at least unfinished college degree. Homicide rate is the number of murders and assaults per 100,000 people in a year calculated at the regional level.

Differential specialisation of regional economies might influence not only vulnerability to the crisis, but the ability of the society to cope with the crisis as well. If, for example, regions with the the lower share of capital goods production also develop institutions that influence change in trust, then our instrumental variable approach would fail to identify an effect of income on trust.

This notion is theoretically plausible, but we contend that it is unlikely. If such institutions do exist, they should manifest themselves in at least some of the observable characteristics of the localities under consideration. As we have seen in Table 1, localities are not systematically different. In particular, the institutions that facilitate cooperation should – if they exist – have an observable impact on criminality. We also consider another alternative channel – exposure to Stalin's repressions. In section 3 of the Online Appendix, we show that the level of criminality, as measured by the homicide rate, does not differ between the regions with different levels of exposure to the crisis and that there is no discernible statistical relationship between exposure to the GULAG camps and our instrument for the decline in economic activity.

In sum, while the assumption of excludability is inherently untestable, we contend that the evidence that we provide – balance on observables and ruling out important potential confounders – strongly suggests that violations of excludability do not seem to be a problem for our research design.

ASSUMPTION 4 ("Monotonicity"). *For all localities, a higher share of pro-cyclical industries increases the probability of a large income fall during the crisis*.

This assumption is sometimes referred to as "no-defiers" assumption. It requires that the direction of the effect of the instrument should be the same for all units. It has been argued that this assumption is "weak", since the main requirement is that for none of the units the effect is the opposite from the one that is encouraged by the instrument (Imbens and Wooldridge, 2007). This assumption is also ultimately untestable.

In our case, a violation of this assumption would mean that for some units, higher levels of capital goods production and production of oil and gas would mean a *lower* vulnerability to crisis. We find such a violation implausible. In particular, Hoynes et al. (2012) find that one of the most stable facts about recessions is their differential effect that is "to a large extent [...] explained by variation in the groups' exposure to cycles across industry-occupation", manufacturing being one of the sectors with the largest exposure to cyclical fluctuations.

It is also worth mentioning that instrumental variable estimation delivers Local Average Treatment Effect (LATE), and not Average Treatment Effect (ATE). Its broader importance relies on the assumption that population of "compliers" – in our case, the regions that had lower-than-median *predicted* change in GRP between 2008 and 2009 (that is, deeper predicted crisis impact) and at the same time lower-than-median *actual* change in GRP between 2008 and 2009 (that is, deeper actual crisis impact) – is not too different from the whole population (Imbens and Angrist, 1994). It is also important that the causal mechanism for "compliers" is the same as for the whole population (Dunning, 2008).

The econometric literature on when and why LATE can be transformed into ATE is work in progress. Here we look at whether a set of "compliers" in our sample differs systematically in observed characteristics from the whole sample (see Table 3 in the Online Appendix). We find that the only significant difference between compliers and other localities is a difference between pre-crisis GDP: "complier" regions are on average richer than other regions. This is understandable: for a region to "comply" (that is, to experience a drop in GDP when exposure to crisis is high), it has to have a relatively high GRP to begin with. Regions with lower GRP may not be able to "comply" because their level of GDP does not allow too much of a downward movement. Also, "complier" regions tend to have lower homicide rates than other regions, though the difference is only marginally significant. In sum, this exercise provides suggestive evidence that "compliers" in our sample are not likely to have a different mechanism that links income to trust than other regions.

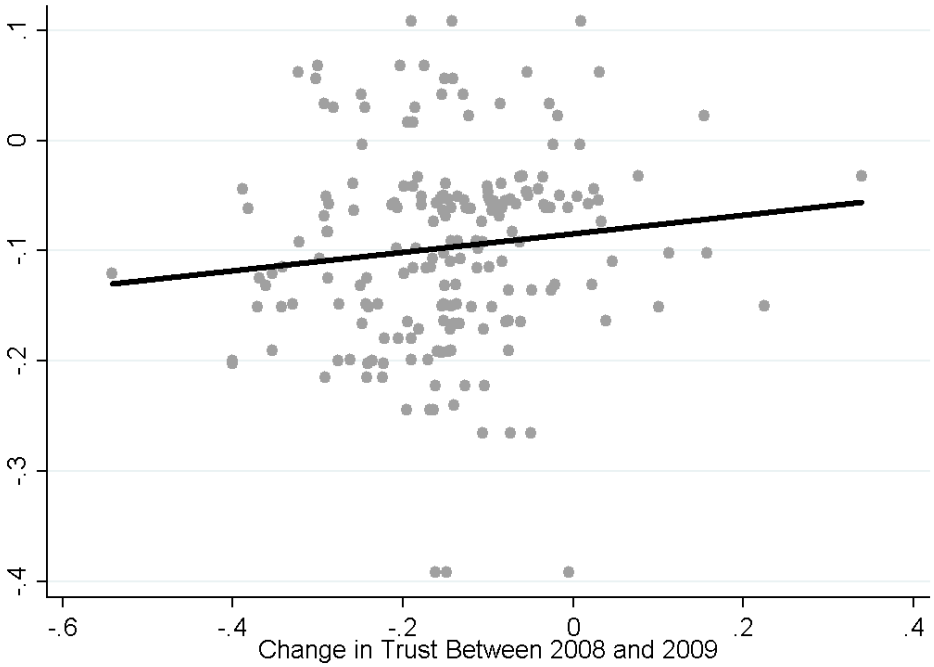
5 Results

5.1 Main results

We first present the OLS results. We regress the difference in trust between 2008 and 2009 on the difference in log GDP per capita and an array of controls (Table 2). The point estimate varies from 0.12 to 0.24, and is not statistically different from zero in most specifications. Figure 7 shows the scatter plot of changes in the sub-regional levels of trust and the changes in gross regional product.

While OLS results cannot reject the absence of the effect of income on trust, these estimations cannot be interpreted causally for two main reasons that can attenuate the real effect. First, there can be endogeneity, since the difference in GDP per capita and the difference in trust can be jointly determined by a change in an omitted variable. Second, as it is usual for difference-in-differences estimation, measurement error can be a serious problem. As GDP is persistent (especially between two adjacent years) and the measure is imperfect, the noise can attenuate the effect.[14]

Figure 7: Change in trust and change in GDP per capita between 2008 and 2009



Sources: FOM, Rosstat

[14] In order to mitigate the problem of the measurement error, we also run OLS and 2SLS regressions where we use quartiles of change in GDP instead of continuous GDP changes. These results are reported in section 7 in Online Appendix; in both OLS and 2SLS specifications, the coefficient at the GDP change is positive and significant.

Table 2: Change in trust and real GDP per capita: OLS estimates

	(1)	(2)	(3)	(4)	(5)	(6)
Real per capita GDP change	0.15	0.13	0.12	0.12	0.13	0.24*
	(0.11)	(0.10)	(0.11)	(0.11)	(0.12)	(0.13)
Homicide change		0.0012	0.0010	0.00098	0.00065	0.00026
		(0.0018)	(0.0017)	(0.0016)	(0.0017)	(0.0017)
Gini change			1.68	1.75	1.38	2.25
			(1.44)	(1.44)	(1.59)	(1.47)
Education change				-0.19	-0.077	-0.15
				(0.22)	(0.29)	(0.30)
Age change					0.060	0.098
					(0.14)	(0.14)
Age squared change					-0.00042	-0.00081
					(0.0016)	(0.0016)
Observations	198	195	195	195	195	189
R^2	0.012	0.010	0.017	0.020	0.085	0.111

Sources: FOM surveys, Rosstat.
Note: The dependent variable is the change in the share of people who answered that "most people can be trusted" in a particular location between 2008 and 2009. The change in the log regional GDP per capita is taken from Russian State Statistics Agency (Rosstat). Changes in Gini and changes in homicide rate are also taken from Rosstat. Individual characteristics (Education, Age, and Age squared) are calculated using the survey responses averaged out at the level of location: regional centre, non-centre urban area, and rural area in a region. *Education* is a share of people with at least unfinished college degree. *Homicide rate* is the number of murders and assaults per 100,000 people in a year calculated at the regional level. In column (6), we exclude the faster growing and the fastest falling regions (Sakhalin and Vologda, respectively). Robust standard errors (clustered by 66 regions) in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Both of these problems can be addressed through the instrumental variable approach. It alleviates the measurement error, and since the Soviet industrial structure is measured before the crisis of 2009, it is plausibly exogenous to the change in trust between 2008 and 2009.

Table 3 shows the results of the first stage of the 2SLS procedure. In all the specifications, the Soviet-time composition of employment does predict the change in income in 2008-09. The instruments are statistically significant and economically relevant predictors of the fall in regional GDP during the crisis. One standard deviation (1.7 percentage point) increase in the employment share in SIC33 in 1989 implies a 4 per cent decline in the regional income in 2009. One standard deviation (1.7 percentage point) change in the SIC35 employment share in 1989

adds another 2 per cent change in regional income. Finally, one standard deviation (half a percentage point) change in the SIC13 employment share in 1989 adds another 2 per cent change in regional income.

Table 3: First-stage estimates: determinants of the change in real GDP per capita

	(1)	(2)	(3)	(4)	(5)	(6)
Primary metals	-2.55***	-2.52***	-2.55***	-2.58***	-2.60***	-1.89***
1989 (SIC33)	(0.67)	(0.68)	(0.69)	(0.68)	(0.68)	(0.44)
Machinery&equipment	-1.30**	-1.52**	-1.56**	-1.53**	-1.53**	-1.68***
1989 (SIC35)	(0.61)	(0.58)	(0.61)	(0.62)	(0.63)	(0.57)
Oil and gas	-4.10***	-4.27***	-4.46***	-4.51***	-4.50***	-4.65***
1989 (SIC13)	(1.27)	(1.26)	(1.36)	(1.35)	(1.32)	(1.19)
Homicide change		-0.0016	-0.0015	-0.0014	-0.0015	-0.00077
		(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0014)
Gini change			-0.83	-0.89	-0.83	-2.26
			(1.69)	(1.69)	(1.67)	(1.50)
Education change				0.12	0.100	0.092
				(0.20)	(0.21)	(0.23)
Age change					0.088	0.060
					(0.083)	(0.090)
Age squared change					-0.0010	-0.00074
					(0.00091)	(0.00099)
Observations	198	195	195	195	195	189
R^2	0.380	0.429	0.432	0.435	0.439	0.408

Sources: FOM surveys, 1989 Soviet Industrial Census, Rosstat.
Note: The dependent variable is the change in the log regional real GDP per capita between 2008 and 2009. All explanatory variables are calculated using two repeated cross-sections of 66 Russian regions. Individual characteristics (Education, Age, and Age squared) are averaged out at the level of location: regional centre, non-centre urban area, and rural area in a region. *Education* is a share of people with at least unfinished college degree. *Gini* is the regional Gini coefficient. *Homicide rate* is the number of murders and assaults per 100,000 people in a year calculated on a regional level. In column (6), we exclude the faster growing and the fastest falling regions (Sakhalin and Vologda, respectively). Robust standard errors (clustered by 66 regions) in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 4 and Figure 8 present the second stage results, where the changes in trust are regressed on predicted income change and a set of controls. The coefficient at the change in real GDP per

capita is statistically significant in all the specifications. They are also economically significant varying from 0.48 to 0.63. This implies that a 10 percentage point fall in income (this is by how much Russian GDP contracted in real terms between the second quarter of 2008 and the first quarter of 2009) corresponds on average to about a 5-6 percentage point decrease in trust. The effect is substantial given that the average level of trust in Russia is relatively low: in 2009, only 19 per cent of FOM respondents told interviewers that most people can be trusted.[15]

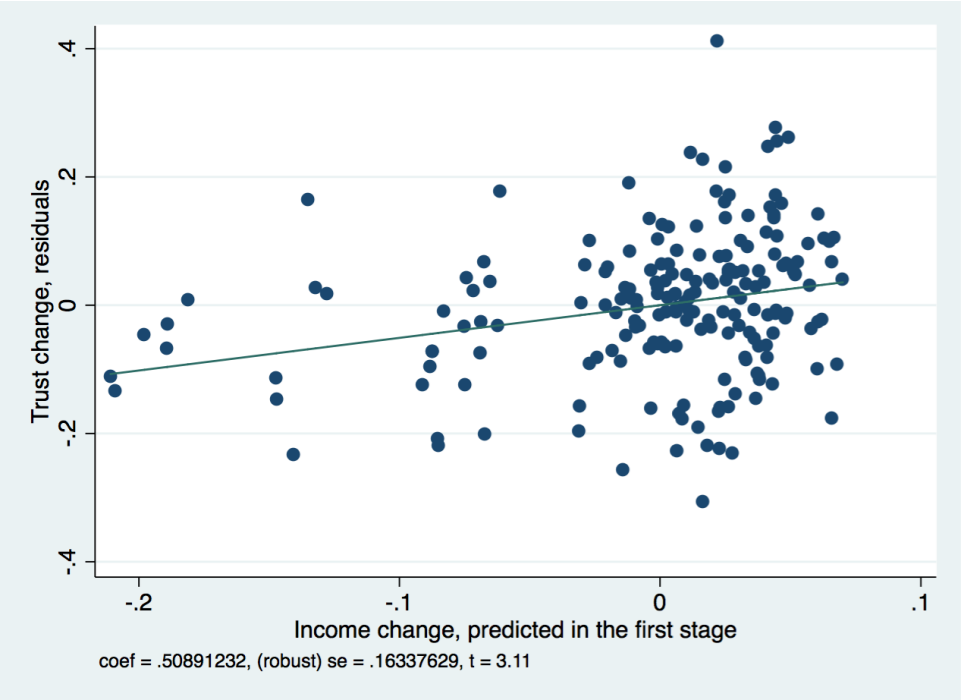
Table 4: Second-stage estimates: determinants of change in trust

	(1)	(2)	(3)	(4)	(5)	(6)
Real per capita GDP change	0.48**	0.53***	0.50**	0.50**	0.49**	0.63***
	(0.20)	(0.20)	(0.20)	(0.20)	(0.19)	(0.20)
Homicide change		0.0025	0.0023	0.0023	0.0019	0.0010
		(0.0019)	(0.0019)	(0.0018)	(0.0018)	(0.0017)
Gini change			1.13	1.22	0.87	2.53
			(1.75)	(1.75)	(1.84)	(1.58)
Education change				-0.22	-0.10	-0.18
				(0.25)	(0.33)	(0.35)
Age change					0.049	0.095
					(0.14)	(0.14)
Age squared change					-0.00029	-0.00075
					(0.0015)	(0.0016)
Observations	198	195	195	195	195	189
F-statistic (excl. instruments)	10.9	12.2	11.7	12.1	12.6	18.8

Sources: FOM surveys, 1989 Soviet Industrial Census, Rosstat.
Note: All variables are calculated using two repeated cross-sections of 66 Russian regions. Individual characteristics (Trust, Education, Age, and Age squared) are averaged out at the level of location: regional centre, non-centre urban area, rural area in a region. *Education* is a share of people with at least unfinished college degree. *Gini* is the regional Gini coefficient. *Homicide rate* is the number of murders and assaults per 100,000 people per year calculated at the regional level. In column (6), we exclude the faster growing and the fastest falling regions (Sakhalin and Vologda, respectively). In all specifications, Hansen J test of overidentification never rejects the null hypothesis. Robust standard errors (clustered by 66 regions) in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

[15] Section 15 in the Online Appendix presents the cross-national scatter plots of trust and GDP per capita. Trust in Russia is 25 percentage points, roughly the same as the world average (25 per cent) and very close to the cross-country trend in both the 2005-08 and 2010-13 waves of the World Values Survey.

Figure 8: Second-stage results: specification (5) from Table 4, residuals of trust change and the predicted income change (instrumented by 1989 employment shares of SIC33, SIC35 and SIC13).



5.2 Heterogenous effects and channels of impact of income on trust

In this section, we perform a subsample analysis and relate it to the different possible mechanisms of influence of income on trust. It is important to acknowledge that any kind of mediation analysis relies on strong assumptions that may or may not be satisfied in this particular case (see, for example, Imai et al. (2011) for the analysis of these assumptions). We view this section only as suggestive evidence and leave more careful mediation analysis for further research.

Income can affect trust through at least two mechanisms that we described earlier. First, as risk aversion usually decreases with income, a lower income may make individuals more risk-averse and therefore less prone to trusting others. Second, a decrease in income may result in individuals updating their beliefs about the fairness of the world around them, hence reducing their willingness to trust others.

In order to distinguish between the two mechanisms, we estimate the differences in the effect of change in income on change in trust for different categories of individuals. In particular, we test whether the effect is stronger for subsamples stratified by age, education and personal income.

The second mechanism (related to learning/inference of the fairness of the world) should be more pronounced for younger individuals (who are relatively early in the process of forming their beliefs about the outside world) and less important for the educated individuals (who may have other signals about the outside world rather than just their own income).

Table 5: Results for the subsamples: second-stage IV estimates

	Income			Age, years			Education	
	Low	Medium	High	18-34	35-53	54+	Low	High
Real per capita GDP change	0.40***	0.33*	0.59***	0.49***	0.49***	0.40**	0.47***	0.52**
	(0.15)	(0.18)	(0.19)	(0.18)	(0.15)	(0.18)	(0.15)	(0.23)
Homicide Change, x100	0.35**	0.24	0.13	0.29	0.24	0.14	0.18	0.22
	(0.14)	(0.29)	(0.27)	(0.20)	(0.20)	(0.22)	(0.16)	(0.32)
Gini Change	-1.21	1.39	2.89	1.78	0.079	1.78	0.79	2.04
	(1.20)	(2.20)	(2.29)	(1.68)	(1.59)	(1.89)	(1.45)	(2.49)
Education Change	0.23	-0.059	0.091	-0.24	0.14	-0.033		
	(0.20)	(0.10)	(0.13)	(0.18)	(0.098)	(0.20)		
Age change, xx100	0.87***	-0.49	0.99**				1.50**	0.11
	(0.31)	(0.37)	(0.38)				(0.73)	(0.37)
N	195	193	195	195	195	195	195	195

Note: All specifications, independent variables and sources of data are the same as in Table 4. The dependent variables are the change of trust for the subsample of individuals from the bottom tercile, the medium tercile and the top tercile of income, respectively, for young, middle-aged and senior people, and for the subsamples with and without higher education. Robust standard errors (clustered by 66 regions) in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

The predictions regarding the first mechanism (related to risk-aversion) are less clear and depend on the functional form of the utility function. Indeed, given the income, the older and the poorer individuals are more risk-averse. However, the effect of age on the marginal change of risk-aversion to change in income depends on the utility function's third derivative. For a standard utility function with a constant relative risk aversion the first mechanism should be more salient for the older individuals (they should be more risk-averse) and for the poorer individuals.

The results for the subsamples are presented in the Table 5. Each column presents the second stage estimates where the first stage is the same as in the Table 1, specification (5). The dependent variable is the change in the average level of trust within the subregion for the individuals with a specific characteristic (low, medium, or high individual income; young, middle-aged, or senior; and with or without higher education). For example, the first column reports the results for the difference in the average level of trust among individuals with low income in 2009 and the average level of trust among individuals with low income in 2008. In the case of income and age, we divide the sample into three equal terciles, while in the case of education we simply separate those with and without tertiary education. The changes in education and in age are calculated within the respective subsamples.

We find that the effect of income on trust is strikingly similar across subsamples. The effect is stronger for the individuals with higher income, for those of younger age and for those with higher education (although the differences are not significant). The first and second results are in contradiction with the risk aversion mechanism. The second result is consistent with the inference mechanism. The third result is in contradiction with the inference mechanism.

It should also be pointed out that the interpretation of the results depends on how the respondents interpret the 'standard' trust question: if respondents interpret it as a question about their experience-based assessment of the trustworthiness of others, then, by splitting the sample by age, education, and income, we might be able to identify whether the data are consistent with it or not. If, however, respondents interpret it as a question about fundamental moral beliefs of others, then the theoretical predictions about the impact of age and education are unclear, because this belief might not follow Bayesian calculus. Overall, the results presented in Table 5 are not conclusive – especially given that the differences in the impact of income of trust between the subsamples are not statistically different.[16]

[16]In section 15 of the Online Appendix we consider the possibility that the results are mediated by trust in government, but find no effect of exposure to the economic crisis on the change in popularity of Russia's government.

6 Additional evidence

6.1 Placebo tests

As discussed in section 4.3, we check if the pattern in Figure 6 holds in regressions. We estimate an instrumental variables specification where the change in income is still instrumented by the 1989 industrial structure, but in the second stage we study the impact of the change in income on the change in trust between 2005 and 2008.[17] Effectively, we test whether our results would still hold for the period between 2005 and 2008. If we found significant positive coefficients in the second stage, it would imply that the relationship between income and trust is driven by unobserved factors unrelated to the crisis. Indeed, in Russia the period between 2005 and 2008 was a time of fast growth rather than recession. According to the official data, Russian GDP in 2008 was 23 per cent higher than in 2005 (in constant prices).

Table 6: Placebo tests, second-stage estimates

	Dependent Variable: Change in Trust in 2005-08					
	(1)	(2)	(3)	(4)	(5)	(6)
Predicted GDPchange in 2008-09	-0.26*	-0.27*	-0.27*	-0.28**	-0.28**	-0.33**
	(0.14)	(0.14)	(0.14)	(0.13)	(0.13)	(0.14)
Homicide change in 2005-08		-0.0015	-0.0015	-0.0019*	-0.0018*	-0.0022**
		(0.0010)	(0.0010)	(0.0010)	(0.0011)	(0.0010)
Gini change in 2005-08			-0.29	-0.16	-0.14	-0.080
			(0.51)	(0.44)	(0.40)	(0.38)
Education change in 2005-08				0.53***	0.53***	0.61***
				(0.16)	(0.15)	(0.12)
Age change in 2005-08					0.28	0.24
					(0.23)	(0.25)
Age squared change in 2005-08					-0.0031	-0.0026
					(0.0026)	(0.0027)
Observations	198	198	198	198	198	192

Note: All specifications, independent variables and sources of data are the same as in Table 4. Standard errors in parentheses are clustered at the regional level. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

The second stage results are presented in Table 6. The coefficients are significant (or marginally significant) but negative. This shows that our results presented in Table 4 are not due to

[17] We have also checked if the income change in 2005-08 is correlated with the Soviet industrial structure but the F-statistics is only 2.8.

pre-existing trends but are indeed related to the shock of crisis that took place between the second quarter of 2008 and the first quarter of 2009. If anything, in 2005-08 the relationship between predicted 2009 income change (instrumented by 1989 industrial structure) and trust was negative rather than positive.

6.2 Robustness checks and alternative explanations

In order to test the robustness of our results, we perform a number of additional tests. First, we try to understand whether any of our three instruments is critical for our results. We remove one instrument at a time and re-estimate regressions with just two remaining instruments. The results are presented in the first three columns of tables 7 (the first stage) and 8 (the second stage). The first specification (using metal products and machinery and equipment only) is especially important as the allocation of oil and gas production may be driven by geographical characteristics that may affect change in trust through other channels.

In all three cases, the effect of income on trust is significant; its magnitude does not change. In one of the specifications, the F-statistic falls to 7 (this is when we only use shares of SIC38 and SIC13 sectors but drop SIC33). In the first specification where we do not use the share of employment in oil and gas, the F-statistic actually increases to 15.

In the fourth column, we reproduce our results with an alternative measure of inequality, the Gini coefficient based on the self-reported income categories (see section 11 in the Online Appendix for the detailed description of these data). We find that the change in this Gini coefficient is negatively correlated with change in trust but its use does not affect the magnitude or the statistical significance of the impact of change in income on change in trust.

The main *alternative explanation* for our results is that the Soviet industrial structure affects change in trust during the crisis through channels different from change in income. It is entirely plausible that regions that have inherited industries specialising in capital goods production and in oil and gas differ from other regions in many respects, including the social fabric and the level of trust. However, it is not clear why these differences should affect the *change* in trust during the crisis. If anything, these regions should have become more (rather than less) resilient to economic volatility. In order to check whether the *level* of trust matters for our estimations of the effects of change in income on trust, we carried out several tests.

First, we checked whether the level of trust is correlated with our instruments. We ran a regression of the level of trust in 2005, 2008 and in 2009 on our instruments and found that the three instruments together explain less than 3 per cent of variation in the level of trust in either year.

We also found that none of three instruments is correlated with the level of trust, except for a positive correlation between the level of trust in 2008 and the share of employment in primary metals in 1989 (with F-statistics equal to 5). Results are presented in Table 4 in the Online Appendix.

Table 7: Robustness checks, first-stage estimates

	(1)	(2)	(3)	(4)	(5)
	Dependent variable: Change in real GRP per capita				
Primary metals 1989 (SIC33)	-2.45***	-3.05***		-2.59***	-2.61***
	(0.65)	(0.50)		(0.68)	(0.67)
Machinery and equipment (SIC35) 1989	-1.29**		-2.31***	-1.50**	-1.53**
	(0.62)		(0.64)	(0.61)	(0.62)
Oil and gas 1989 (SIC13)		-3.59***	-3.46**	-4.32***	-4.45***
		(1.26)	(1.55)	(1.23)	(1.36)
Homicide change	-0.0023	-0.0013	-0.0031	-0.0017	-0.0015
	(0.0016)	(0.0016)	(0.0021)	(0.0015)	(0.0015)
Gini change	-0.045	-0.26	0.035	0.060	-0.80
	(1.70)	(1.56)	(2.51)	(0.059)	(1.65)
Education change	0.068	0.17	-0.0023	0.085	0.094
	(0.20)	(0.23)	(0.22)	(0.20)	(0.22)
Age change	0.089	0.084	0.048	0.088	0.090
	(0.087)	(0.090)	(0.090)	(0.080)	(0.084)
Age squared change	-0.0010	-0.00097	-0.00056	-0.0010	-0.0010
	(0.00095)	(0.00098)	(0.00099)	(0.00087)	(0.00092)
Trust in 2005					0.077
					(0.059)
Observations	195	195	195	195	195
F-statistic (excluded instruments)	15.6	22.4	7.0	12.9	12.8

Note: All specifications, independent variables and sources of data are the same as in Table 3. Standard errors in parentheses are clustered at the regional level. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

Our second test of this alternative explanation involved controlling for the level of trust in our main regression. The results are presented in column (5) in tables 7 and 8. We include the level of trust in 2005 and find that the impact of change in income on change in trust remains the same in terms of both statistical and economic significance. The coefficient at the level of trust in 2005 is not significant, either in the first stage or in the second stage. This implies that controlling for the predicted change in income the initial level of trust in 2005 has no impact on the change of trust between 2008 and 2009; nor controlling for the initial level in trust has an effect on the magnitude and the significance of the effect of change in income on change in trust.

Table 8: Robustness checks, second-stage estimates

	(1)	(2)	(3)	(4)	(5)
Real per capita GDP change	0.47**	0.51**	0.44*	0.45**	0.49***
	(0.22)	(0.25)	(0.24)	(0.19)	(0.19)
Homicide change	0.0018	0.0020	0.0017	0.0022	0.0018
	(0.0018)	(0.0018)	(0.0020)	(0.0016)	(0.0018)
Gini change	0.90	0.83	0.93	-0.79***	0.82
	(1.79)	(1.83)	(1.93)	(0.28)	(1.84)
Education change	-0.10	-0.10	-0.099	-0.018	-0.090
	(0.32)	(0.33)	(0.32)	(0.25)	(0.34)
Age change	0.050	0.048	0.051	0.073	0.046
	(0.14)	(0.14)	(0.14)	(0.14)	(0.13)
Age squared change	-0.00029	-0.00028	-0.00030	-0.00059	-0.00025
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)
Trust in 2005					-0.16
					(0.13)
Observations	195	195	195	195	195

Note: All specifications, independent variables and sources of data are the same as in Table 4. Standard errors in parentheses are clustered at the regional level. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

Finally, we have checked whether the sensitivity of trust to economic hardship is driven by historical legacies that may also be correlated with our instruments. We use two measures that may capture the extent of the harshness of the Soviet regime: the percentage of Communist Party members in the region's population in 1976 (Libman and Obydenkova, 2013) and the number of GULAG's prisoner-years per capita (using the data from Mikhailova (2012) and official data on regions' population in 1939).

We find that neither the share of Communist Party members (Table 5 in the Online Appendix, column 2) nor the size of GULAG camps per capita (Table 8 in the Online Appendix) is correlated with the level of trust. We do find that the share of primary metals and of oil and gas in 1989 is negatively and significantly correlated with the share of Communist Party members (Table 5 in the Online Appendix, column 1). However, controlling for our three instrumental variables, the percentage of Communist Party members does not have a significant impact on the change in income (Table 6 and Figure 3 in the Online Appendix).

Moreover, in the second stage neither the percentage of Communist Party members nor its interaction with the income (instrumented by the industry structure) has a significant impact on

the change in trust (Table 7 in the Online Appendix).

We find that size of GULAG camps per capita is not correlated with Soviet industrial structure in 1989 (Table 8 in the Online Appendix). We also find that neither the size of GULAG camps per capita nor its interaction with the income (instrumented by the industry structure) has a significant impact on the change in trust (Table 9 in the Online Appendix).

These results imply that these long-term historical variables are not correlated with trust; nor do they have an effect on the sensitivity of trust to income change during the crisis (instrumented by the structure of the regional economy).

We have also checked whether the relationship between trust and income is non-linear. We ran specifications with squared change in income as well as using a semi-parametric estimation for regressions in Table 4. We found no non-linearities (regressions available on request). The coefficient at squared income change is not significant, and the non-parametric relationship between change in trust and change in income (Table 4 and Figure 8) is virtually linear.

We also perform a variety of additional tests: estimate a regression with a discrete measure of recession instead of a continuous one (section 7 in the Online Appendix), confirm that our results are not driven by the outliers (section 8 in the Online Appendix), check that our results remain the same once the observations are aggregated on the regional level (section 9 in the Online Appendix), control for the pre-crisis level of trust (section 10 in the Online Appendix), estimate a set of individual-level regressions to demonstrate that people who have larger incomes are more likely to have higher levels of trust (section 11 in Online Appendix)[18].

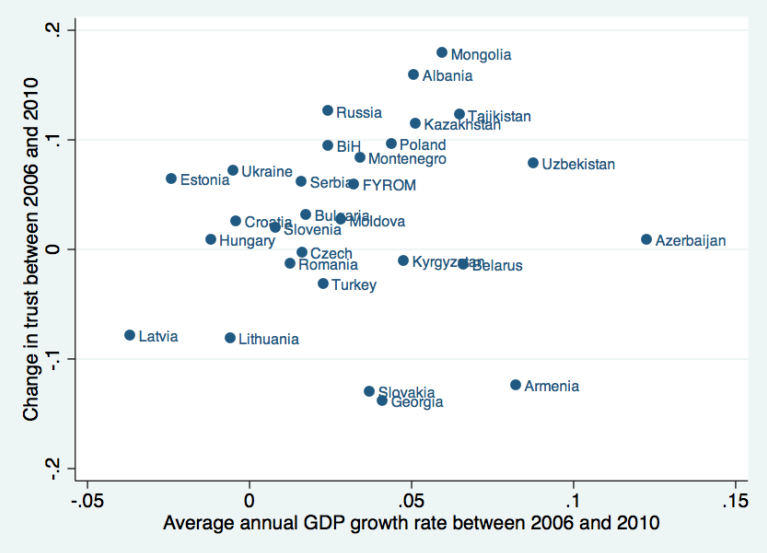
[18]Our results are consistent with Alesina and La Ferrara (2002)

7 External validity and international evidence

The results above provide evidence on the relationship between income and trust within one country. In order to understand whether these results are driven by unique features of Russia, in this section we study data from the Life in Transition Survey (LiTS) run by the European Bank for Reconstruction and Development and the World Bank in 2006 and 2010. We will try to see, first, to what extent a large change in the level of trust observed in Russia in 2009 is unusual, and, second, whether the decrease in income due to the crisis has a similar effect on trust in other countries, not just in Russia.

In 2006, LiTS covered 29 transition countries (including Mongolia and Turkey). In 2010, it was expanded to 35 countries adding France, Germany, Italy, Kosovo, Sweden, and the UK. In each country, the survey was administered on a representative sample of about 1,000 respondents in rural and urban primary sample units (PSUs) with 20 respondents per PSU. Figure 9 shows the change in average level of trust in countries that participated in both 2006 and 2010 surveys along with the average annual growth rate of GDP between the two surveys. We see that large changes of trust during this period were quite common.[19] Also, except for a few outliers (the Slovak Republic plus war-torn Georgia, Armenia and Azerbaijan), there is a positive correlation between GDP growth and change in trust. The slope of this relationship is about 0.24 percentage point change in trust for a 1 per cent change in GDP.

Figure 9: GDP growth and change in trust between 2006 and 2010



Sources: Life in Transition Survey, World Development Indicators.

In 2006 and 2010, LiTS was undertaken in different locations. Therefore we cannot use a cross-section of differences similar to the one we used for Russia in section 5. Also, the sample was not representative at the PSU level. Therefore the evidence in this section can only be

[19] See also Grosjean and Ricka (2013), who use LiTS data to show that the crisis also resulted in large changes in attitudes to market and to democracy.

viewed as illustrative. Yet, it is interesting to see whether the relationships between effect of the crisis, income, and trust still hold in the international data, at least in cross-sectional regressions.

We also use LiTS 2010 individual data to calculate vulnerability to crisis. Following Grosjean and Ricka (2013), we use their "synthetic consumption response index" as a proxy for the effect of the crisis: we add up positive responses to the questions about whether individuals had to reduce consumption of staple foods, limit tobacco smoking, delay medical appointments, postpone buying necessary medications, and accumulate arrears on utility bills.

The results are presented in Table 9. In column 1 we regress the individual level of trust on the "synthetic consumption response" controlling for individual characteristics and country dummies. We find a negative and significant coefficient at the consumption response variable. This effect does not change magnitude and remains significant even when we control for the average consumption response within the PSU. The effect of average consumption response itself, however, is small and not significant.

Table 9: Individual-level OLS regressions based on the Life in Transition Survey

	(1) Trust	(2) Trust	(3) Income	(4) Trust
Consumption Response	-0.0154***	-0.0149***	-0.265***	-0.00793
	(0.00378)	(0.00303)	(0.0208)	(0.00573)
Average Consumption Response		-0.00213		
		(0.0120)		
Income				0.3080***
				(0.0039)
Female	-0.0162***	-0.0162***	-0.0820**	-0.0223**
	(0.00563)	(0.00563)	(0.0339)	(0.00994)
Education	0.0682***	0.0682***	0.482***	0.0490***
	(0.00733)	(0.00733)	(0.0377)	(0.0114)
Age	0.000457	0.000448	-0.0132**	0.00111
	(0.00103)	(0.00102)	(0.00601)	(0.00186)
Age Squared	-1.12e-06	-1.04e-06	3.08e-05	-1.35e-05
	(9.57e-06)	(9.54e-06)	(5.79e-05)	(1.72e-05)
Country Fixed Effects	Yes	Yes	Yes	Yes
Observations	38,864	38,864	13,967	13,967
R-squared	0.067	0.067	0.142	0.066

Source: Life in Transition Survey 2010.
Note: *Consumption Response* is a measure of reduction of basic consumption items (stable food etc.) constructed by a procedure of Grosjean and Ricka (2013). *Income* is the self-reported decile of within-country income distribution.

In columns 3 and 4 we investigate the relationship between crisis impact, trust, and income. LiTS does not include questions on income per se, yet the respondents provide their relative

rank in income distribution within a country. Therefore, once we control for country dummies, we can use this variable as a measure of household income. We find that income is indeed lower in households who report a higher consumption response (column 3). We also find that income and trust are positively correlated even if we control for consumption response (column 4). Moreover, once we include income, the consumption response becomes insignificant. This is consistent with a conjecture that crisis impacts trust through income.[20]

[20]Figure 8 in the Online Appendix presents a scatter plot of the predicted probability of trust (from the linear probability model of column 1) and the consumption response.

8 Persistence of the decline in trust

We have shown that Russian regions with a higher vulnerability to the crisis had a larger decrease in trust in 2008-09 than the regions with the smaller vulnerability. Is the effect persistent? Does trust go up again when the economy recovers or does it remain stuck at the low level? In this section, we offer evidence that suggests the effect is persistent at least in some regions; trust does not always improve even when the income is restored.

In 2014, we asked the Public Opinion Foundation (FOM) to include once again the question about generalised trust in their GeoRating survey. The survey was conducted in April 2014 using the same methodology and same locations as the surveys in 2008 and 2009.

As shown in Figure 2, by 2014 Russian GDP had recovered from the 2009 crisis and exceeded its pre-crisis level. In the second quarter of 2014, Russian GDP was 5 per cent higher (in constant prices, seasonally adjusted) than in the second quarter of 2008.

On average, the level of trust did increase after the fall in 2008: it was 34 per cent in 2008, 19 per cent in 2009, and 29 per cent in 2014. However, this improvement has not been uniform: trust has recovered in the regions where it had not gone down significantly in the first place. In those regions, where trust decreased significantly in 2009, it remained far below its pre-crisis levels even in 2014.

To demonstrate this, we divide the sample into two halves based on the median change in the level of trust between 2008 and 2009 and compare the subsequent changes in trust between 2009 and 2014. If the initial decrease in trust was larger than the median (15 percentage points), we call such a decrease "large"; if it was smaller than the median, we call it "small".

Table 10: Evolution of trust in Russian regions in 2008-2014

	Level in year 2008	Change between 2008 and 2009	Change between 2009 and 2014
Full Sample	0.34	-0.15	+0.10
Subsample: "Large Decrease"	0.39	-0.23	+0.14
Subsample: "Small Decrease"	0.28	-0.06	+0.08

Table 10 shows the evolution of trust since 2008 in the full sample of Russian regions, in the regions with the large 2009 decrease in trust, and in the regions with the small 2009 decrease in trust. In the full sample, between 2008 and 2009 trust decreased by 15 percentage points, and then increased by 10 percentage points between 2009 and 2014. The areas with the small initial decrease in trust have recovered to the initial level (and even slightly exceeded it), but the areas with a large initial drop in trust have not. Between 2009 and 2014 trust in those areas went up by 14 percentage points; trust remained about 10 percentage points lower than its pre-crisis level.

The differences in the changes in trust between regions with large and small drops in income are economically important and statistically significant. Table 11 presents the results of the

following simple estimation:

$$\Delta Trust\_0814_i = \alpha + \beta LargeDecrease_i + \epsilon_i \quad (3)$$

where $\Delta Trust\_0814_i$ is a change in trust between 2008 and 2014 in a subregion i, and $LargeDecrease_i$ is an indicator variable for a decline in trust between 2008 and 2009 being larger than the median (larger than 15 percentage points).

These results imply that in the regions where the impact of the crisis (the change in 2008-09) was large, the long-term (2008-14) decrease was also 11.5 percentage points larger. In the other regions, the difference between 2008 and 2014 levels of trust was positive and small (+1.5 percentage points) and not significantly different from zero.

Table 11: Long-term change in trust

	Change in trust between 2008 and 2014
Dummy for large decrease in trust	-0.115***
	(0.0240)
Constant	0.0154
	(0.0198)
Observations	195
R-squared	0.125

Sources: FOM surveys, Rosstat.
Note: Robust standard errors (in parentheses) are clustered at the regional level.
*** p<0.01, ** p<0.05, * p<0.1

To show that the trust was more likely to recover in places, where the initial drop was not small, we estimate the following regression for the two subsamples:

$$\Delta Trust\_0914_i = \alpha + \beta_1 \Delta Trust\_0809_i + \beta_2 \Delta GDP_i + \beta_3 \Delta Educ_i + \beta_4 \Delta Gini_i + \epsilon_i \quad (4)$$

where $\Delta Trust\_0914_i$ is the change in the level of trust in subregion i between 2009 and 2014. ΔGDP_i is the change in Gross Regional Product per capita between 2009 and 2014.$\Delta Educ_i$ is a change in the proportion of people with at least incomplete higher education between 2009 and 2014, $\Delta Gini_i$ is change in Gini coefficients between 2009 and 2014.

If trust recovers after the crisis, we expect β_1 to be negative and large in absolute value: the larger is the decline during the crisis, the faster the subsequent recovery.

Table 12 presents the results (as a robustness check, Table 18 in the Online Appendix presents the results controlling for the depth of the recessions). We find that the coefficient β_1 is negative and large only in the sample with the small 2009 decline. In the sample with the large 2009 decline, the subsequent evolution of trust is not related to the fall of trust during the crisis.[21]

[21] We have also tried to divide the sample into the areas with large versus small decrease of trust using the *predicted* (rather than *actual*) change in trust during the crisis. The results (available on request) are the same.

Table 12: Changes in trust between 2009 and 2014

	Subsample: Large decrease in trust in 2008-09		Subsample: Small decrease in trust in 2008-09		Full sample	
Trust change in 2008-2009	0.036	0.011	-0.62***	-0.65***	-0.30***	-0.26**
	(0.15)	(0.16)	(0.19)	(0.20)	(0.11)	(0.10)
Per capita GDP change	0.13***	0.17***	0.45***	0.22***	0.15**	0.18***
	(0.041)	(0.039)	(0.19)	(0.21)	(0.066)	(0.061)
Gini change		-0.42		-0.066		-0.35
		(0.29)		(0.26)		(0.23)
Education change		-0.084		0.73***		0.35**
		(0.14)		(0.22)		(0.14)
Observations	97	97	98	98	195	195
R-squared	0.053	0.086	0.145	0.280	0.102	0.172

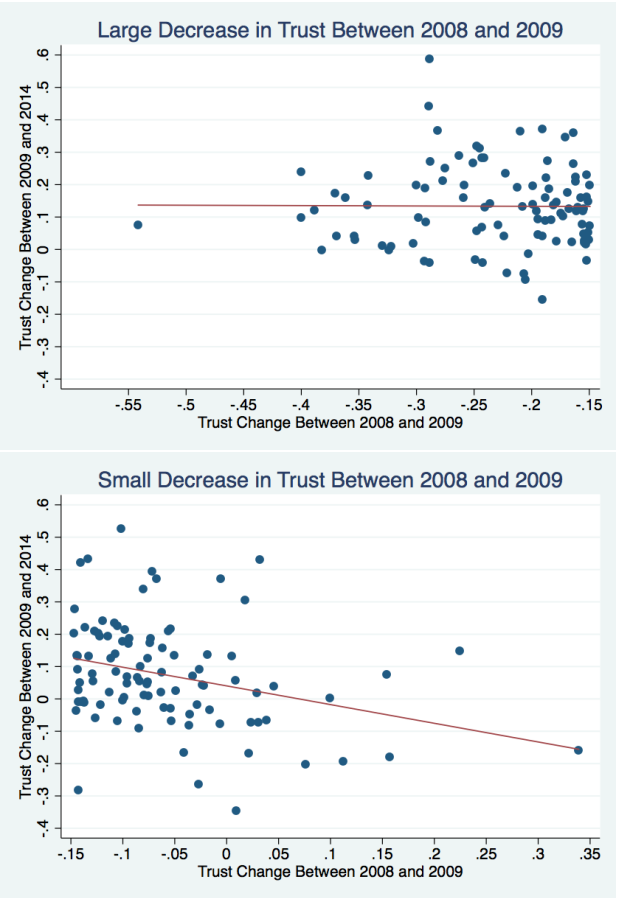
Sources: FOM surveys, Rosstat.
Note: Robust standard errors (in parentheses) are clustered at the regional level.
*** p<0.01, ** p<0.05, * p<0.1

If the decrease is small, then 10 percentage points of the decrease in trust in 2008-09 are associated with 6 percentage points of the post-crisis recovery. If the decrease is large, then the subsequent trajectory is not related to the initial decrease.

The results are presented in a graphical form in Figure 10. The left panel shows the residual plot for the subsample with the small decrease during the crisis, and the right panel shows the residual plot for the subsample with the large decrease. While the regression line in the plot with the small drop has a negative slope signifying that the recovery of trust between 2009 and 2014 was proportional to its decrease during the crisis, the fitted line in the sample with the large drop is flat showing no relationship between the initial drop in trust and subsequent recovery.

This evidence is consistent with the hypothesis that if the income shocks result in a substantial decrease in trust then the effect may persist even after income bounces back to the initial level.

Figure 10: Post-2009 recovery of trust in the subsamples with small and large decreases in trust in 2008-09



9 Concluding remarks

In this paper, we study the relationship between changes in income and changes in trust. In order to identify the causal effects, we use the sharp – and spatially uneven – decline in Russian GDP at the end of 2008 and the beginning of 2009. We find that the economies of those regions that historically relied on the production of capital goods and oil and gas were more vulnerable to the global crisis and therefore experienced a larger decline in trust than other regions.

We interpret the results presented in this paper as evidence in favour of the effect of income on trust. Alternative explanations of our results would have to argue that regional economies specialising in capital goods may have developed special social institutions. While it is entirely plausible to assume that such institutions affect the *level* of trust in these regions, it is difficult to understand why these institutions should have an impact on the *changes* in trust over a very short period of time. And even if such a relationship between industrial specialisation and resilience of trust to crisis existed, it would be likely to work in the opposite direction: regions vulnerable to crisis should have been more – rather than less – resilient in challenging times. This is why we believe that our results imply that inherited industrial structure affects trust through income.

Our results cannot distinguish between different explanations of the relationship between income and trust – whether it is driven by risk aversion or by inference based on income (or other potential explanations). But whatever the origin of the effect of income on trust, its magnitude is substantial: on average, a 10 percent decline in income is associated with a 5 percentage point decrease in trust. Given the low average level of trust in Russia (25 per cent according to the World Values Survey), this is a substantial effect.

We also study the post-crisis evolution of trust in Russian regions to understand whether the impact of crisis on trust had a persistent or a transitory effect. After the deep recession in 2009 Russian GDP has returned to the pre-crisis levels and even exceeded them in 2012-14. Trust also rose but did not return to its pre-crisis levels. We find that the change in trust after the crisis was very heterogeneous. In the regions where the decline in trust was small, trust fully recovered to the pre-crisis level. However, in those regions where the shock of crisis on trust was strong, the impact of crisis was persistent: in 2014, trust in those regions was still 10 percentage points below the respective 2008 levels.

These findings shed a new light on our understanding of the social costs of recessions and have very clear policy implications. If governments are capable of executing efficient fiscal policy, they should respond quickly and decisively to crises with countercyclical social policies in order to prevent the recession's strong impact on trust — as the latter may have lasting implications for trust even after the recession is over.

Do our results matter? Is self-reported generalised social trust in Russia correlated with pro-social behaviour? We have carried out three exercises; all produced a positive answer.[22]

[22]It is important to point out that our quasi-experimental setting only allows us to study the *determinants* of change in trust and not its *implications*. As crises and recessions have many negative social implications, our data do not allow us to separate the impact of the fall in trust from the direct effects of income shocks. This is why we

First, we have checked whether a survey-based measure of trust is correlated with Russians' internet searches. We have calculated the shares of searches for "donate blood", "charitable foundation", "orphanage", "adopt a child", "social protection" in April 2014 for each Russian region. We constructed a principal component of these search shares and it turns out that this principal component is correlated with our survey-based trust measure (in April 2014) controlling for income per capita, internet penetration, inequality, urbanisation, education, infant mortality, and homicide rate; The correlation is statistically significant (see Guriev and Melnikov 2016 for the discussion of Internet search data we use). Second, we have collected the data on the number of blood donors per capita in each region in 2013.[23] The number of donors is correlated with survey-based measures of trust even if we control for income per capita, inequality and other socio-economic characteristics. Third, we have checked the data on personal pro-social behaviour from a one-off survey run by FOM and the Higher School of Economics in 2007. These data show that a survey-based measure of trust is correlated with every self-reported measure of pro-social behaviour: help to non-family members, volunteer work, participation in NGOs, and monetary donations to charities (see section 16 in the Online Appendix).

While trust is correlated with pro-social behaviour, it turns out that it is not – at least in 2008-09 – correlated with Russians' political attitudes such as approval of Vladimir Putin and trust in government (see section 17 in the Online Appendix).

We should make two caveats. First, the episode that we are analysing is the episode of deep global recession that caused large decreases in the incomes of many people. Our results might not be applicable to more "ordinary" recessions, when the drop is not so large. Second, it is important to make a conceptual distinction between the effect of aggregate shocks and the individual changes in income. Our identification strategy relies on the aggregate changes in trust and in income and thus can be consistent with both of these mechanisms. We perform an array of additional exercises in section 5.2 which suggest that the economic crisis might influence trust through its impact on individual income. We view those results as tentative and complementary to our main results, leaving more detailed exploration of the mechanisms for further research.

can only talk about correlations between trust and pro-social behaviour rather than the *impact* of trust on pro-social behaviour.

[23] The data are published on yadonor.ru website by the "Blood Service" programme.

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