The Legacy of Surveillance: An Explanation for Social Capital Erosion and the Persistent Economic Disparity Between East and West Germany[*]

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Abstract

This paper presents an exemplary case of social capital destruction through state action. In spite of being a unified country for almost one generation, with common legal, administrative, judiciary, education, regulatory, and tax systems, East and West Germany are characterized by remarkable differences in economic performance. We investigate the patterns of economic backwardness in East Germany and put forward a formal model and empirical evidence in favor of an intuitive yet compelling novel conjecture: the differences in the scale and depth of the penetration of people's private lives as well as of the institutions of state and society across the regions in the former GDR have significant bearing on the social capital patterns observed in East Germany today. Our empirical evidence suggests that a one standard deviation increase in Stasi informer density is associated with a 0.6 percentage point decrease in electoral turnout, a 10% decrease in organizational involvement, and a 50% reduction in the number of organs donated across the districts in East Germany. We furthermore find robust evidence that surveillance intensity has a strong negative effect via social capital on current economic performance, and may explain approximately 7% of the East-West differential in income per capita and 26% of the unemployment gap. Our results are rare empirical evidence towards a better understanding of the mechanisms through which social capital accumulates and depreciates, and thus informative for policy-makers.

Keywords: Surveillance, Social Capital, Economic Performance, Oppressive Regimes

JEL Classification: A13, E0, E17, E65, P30

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1 INTRODUCTION

The social capital literature has established itself as a mature and influential sub-field in the social sciences, and in economics, in particular. Yet, one of this literature's topics that is most consequential for policy-making and our understanding of social capital – the mechanisms through which social capital accumulates and depreciates – remains largely unexplored.[1] As Guiso, Sapienza, and Zingales (2010) explain, a better understanding of these mechanisms is clearly required if policy-makers want to design policies that foster the formation and preservation of social capital, and avoid policies that, while producing short term benefits, undermine social capital in the medium to long term, with negative long term economic effects. This paper presents an exemplary case of social capital destruction through state action.

In spite of having been a unified country for the last 20 years with common legal, administrative, judiciary, education, regulatory, and tax systems Germany is characterized by remarkable differences in economic performance between its regions in the West and its regions in the formerly communist East: the five East German federal states top the list of *Länder* with the highest unemployment rate and the lowest GDP per capita. Unemployment stands at 13.5% in East Germany but at only 7.2% in West Germany[2]; disposable income of the private households per capita amounts to only €14,700 in the East, but to €19,200 in the West.[3] This persistent disparity on many economic accounts is even more surprising, when one takes into consideration that a total of €156.5 billion will have been transferred to East Germany by 2019 for closing the infrastructure gap and for adjusting the under-proportional local financial power, as laid out in the solidarity pact (*Solidarpakt*) which came into force in 1995.

Unsurprisingly, debate has erupted over whether or not East and West Germany will eventually converge in terms of economic performance. The Institut der Deutschen Wirtschaft (IW) (2009), one of Germany's leading private economic research institutes, recently cheered that East Germany's economy is on a good path towards reaching level with the some of the federal states in the West within the next twelve years. However, there exists notably more pessimism among scholars, politicians and practitioners in Germany. In fact, the remarkable similarity in economic fissures between West and East Germany on the one hand, and North and South Italy on the other (see, for example, Putnam, 1993; Guiso, Sapienza, and Zingales, 2008), has led some scholars to even use the mezzogiorno analogy in the debate about East German development (see, for example, Boltho, Carlin, and Scaramozzino, 1997; Heilemann, 2005; Sinn and Westermann, 2001). Even the optimistic IW agrees that in the foreseeable future it cannot be expected that East Germany fully closes the

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[1]Empirical evidence of the consequence of state action for the development or destruction of social capital is largely absent in the literature to date. As one of the few explicit empirical examples, Gans (1962) describes the destruction of a vibrant, working community through "bulldozer urban renewal" of affordable houses in the Boston West End.

[2]As of March 2010 (Source: German Federal Statistics Office).

[3]Figures are for 2006 (Source: German Federal Statistics Office).

gap on the West.

In this paper, we investigate the patterns of economic backwardness in East Germany by putting forward a formal reciprocity model and empirical evidence in favor of an intuitive novel conjecture: the differences in the intensity of Stasi surveillance and repression across the regions in the former GDR have significant bearing on the social capital patterns observed in these regions today, which in turn inform economic outcomes. Our approach is motivated by the considerable body of scholarly work (for example Tabellini, 2010; Guiso, Sapienza, and Zingales, 2006) that attributes the persistence of differences in economic development to social capital, referred to as the connections among individuals, and the norms of reciprocity and trustworthiness that arise from them (Putnam, 2000). Social capital calls attention to the fact that social constructs affect the productivity of individuals and groups, and that civic virtue is most powerful when embedded in a dense network of reciprocal social relations (Putnam, 2000, p.19). Spending time in associations, investing in negotiation and cooperation makes it possible for individuals to gather information about the true cooperative nature of the society. In Tocqueville's (1969) words, associations are small social laboratories for experimenting cooperation and building up democracy. Howard (2003) points out that for East Germany having benefited from West German wealth and institutions since unification, the expectation is that it should have a strong and vibrant civil society today. Contrary to these expectations, however, most studies show that participation in voluntary associations in the East is low and that the gap between West and East remains very large.[4]

The explanation we have in mind is as follows. People's current behavior is shaped by their prior experiences and how they interpret those experiences (Howard, 2003). We posit that people's experience of living in a regime with the world's most pervasive and intrusive surveillance apparatus has resulted in a strong and lingering sense of mistrust of members of society outside the immediate family circle in post-communist East Germany. To ensure that the people would become and remain submissive, the ruling party in the GDR saturated its realm with more spies than had any other totalitarian regime in history. When the regime collapsed, the East German secret police Stasi had 91,015 full-time officers and noncommissioned personnel on its rolls, as well as 173,081 regular Stasi informers (*inoffizielle Mitarbeiter*, IMs) – on a total population of just 16.675 million people (Giesecke, 2006; Müller-Enbergs, 2008). Alas, the regime was not content to rely only on the Stasi's hundreds of thousands of informers to ferret out anti-state sentiments – the regime also created a law that made the failure to denounce fellow citizens a crime punishable by up to five years' imprisonment. As a result, an environment was created that narrowed social and cultural horizons, and fostered cultural traits that demoted social spiritedness and hurt economic development: mistrust of unfamiliar people, limited as opposed to general morality, a sense of individual helplessness and resignation (cf. Dennis, 2003).

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[4]See, for example, Wessels (1992); Anheier, Priller, Seibel, and Zimmer (1998); Padgett (2000)

Today, the desire to participate in voluntary organizations and to cooperate with other members of society – essential to bridge the wide gap between private and public spheres, and to build trust extending beyond the immediate family circle – may actually be incompatible with people's prior experiences with organizations and individuals in the GDR, since they generally viewed them, and still view today, with suspicion and mistrust (Howard, 2003, p.26). To be sure, we do not posit that life in the East was apolitical or asocial. On the contrary, certain social connections have been essential to survival and well-being in this land of "bend down goods" (*Bückware*).[5] However, these bonds, while they existed, were strictly limited in scope and directed exclusively at intimate friends and immediate family members. These bonds did not allow experimenting freely civic interaction and cooperation.

Our empirical evidence suggests an important insight: dense networks of state security surveillance in the former GDR have undermined people's ability to experiment cooperation freely and reduced both their scope of cooperation and their priors about the trustworthiness of other members of society. Recovery of these indicators of social capital is only gradual after democratization and helps explain the persistent differences in economic performance currently observed between East and West Germany. To be specific, we find that a one standard deviation increase in the Stasi informer density (about 2.73 informers per thousand people) is associated with a 0.6 percentage point decrease in current electoral turnout, a 10% decrease in organizational involvement, and a 50% reduction of the number of organs donated post mortem in the districts in our sample. Furthermore, we find robust evidence that surveillance intensity has a strong negative effect via social capital on current economic performance. Because West Germany during the same historical period did not experience a similar oppressive regime shock, our results suggest that scale and depth of penetration of people's private lives, and the ensuing social capital erosion in East Germany, may be an important explanatory factor for the persistent differences in economic prosperity between East and West Germany. Our regression evidence suggests that surveillance via social capital may explain approximately 7% of the East-West differential in income per capita and 26% of the unemployment gap. To our knowledge, this is the first study that presents empirical evidence of the effect of state security surveillance on current social capital and economic performance in East Germany.

The remainder of this paper is organized as follows. Section 2 lays out the historical background and motivation for our study. In Section 3, we develop our formal model and analyze its key predictions. We simulate our model outcomes for different parameters in Section 4. In Section 5, we test the validity of our model predictions using empirical data on informer density in the districts of the former GDR, and we test the robustness of our evidence to reverse causality concerns and alternative measurement and specification strategies. We conclude in Section 6.

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[5]In the GDR the term 'Bückware' described rare and imported goods which were only sold under-the-counter.

2 THEORETICAL BACKGROUND AND MOTIVATION

There are various channels through which an oppressive regime shock can alter value underpinnings of a society and erode trust. While our example of East Germany provides a host of potential channels from collectivization of agricultural land to confining a people behind a wall, in this paper we focus in particular on how the GDR state security, which monitored the lives of East German citizens and suppressed alleged dissenters through its pervasive network of informers, might have led to social capital erosion.

2.1 The GDR State Security

By origin and design, the Ministry of State Security (*Ministerium für Staatssicherheit*, MfS), commonly known as the *Stasi*, operated as the official secret police of the former German Democratic Republic (GDR). It watched over and fought against opponents of the Party dictatorship or those it held to be such. The Stasi strove to bring the whole society under its control, which made it by far the "most frightening and at the same time the most grotesque part" of the power apparatus of the GDR state (Klessmann, 1998, p.39).

By the time East Germany collapsed in 1989, the Stasi payroll had grown to 91,015 full-time employees (Giesecke, 2006). On top came a network of civilian informants, regular informers, and part-time snoopers which grew rapidly in the 1960s and 1970s, and remained nearly constant from the second half of the 1970s. This "main weapon in the fight against the enemy" (Müller-Enbergs, 1996, p.305) was nothing short of monstrous: approximately 173,081 unofficial informers probed every aspect of citizens' lives, carried out concrete assignments for their control officers, made their flats available for meetings or observations, searched flats and workplaces, and shadowed suspects with bugs and cameras and through telephone, radio and postal surveillance (Giesecke, 2006). Table 1 provides an overview of different categories of IMs and their headcount.

The Stasi closely monitored political behavior among GDR citizens, and is known to have used torture and intimidation to mute dissent. Without exception, one tenant in every apartment building was designated as a watchdog reporting to area representatives of the Stasi (Koehler, 1999) and full-time officers were posted to factories and important installations and facilities. As Koehler (1999) puts it, it would not have been unreasonable to assume that at least one Stasi informer was present in any party of ten dinner guests.

The GDR's vast apparatus of surveillance and repression was unprecedented in scale and depth: it was proportionally by far the most extensive state security service in history. For every 1,000 GDR citizens there were approximately 5.5 state security personnel and another 11 unofficial informers. About 1 in 50 of the country's adults were working for the Stasi and enabled the ministry to conduct an almost blanket surveillance of society (Dennis, 2003). The Stasi

thus dwarfed, for example, the Nazi Gestapo, which employed 40,000 officials to watch a population of 80 million (one officer per 2,000 citizens) and the Soviet KGB, which employed 480,000 full time agents to oversee a nation of 280 million residents (one agent per 583 citizens) (Koehler, 1999).

Table 1: Unofficial Informers as of December 31, 1988

This table reports the number of unofficial informers (IMs) active for the Ministry of State Security as of December 31, 1988 (without Main Directorate A). Source: Müller-Enbergs (2008).

	Absolute	Percentage
Unofficial Informers, thereof	109,281	63.1%
- informers to safeguard areas of responsibility	93,629	54.1%
- informers with enemy contact	3,894	2.2%
- expert IMs	7,167	4.1%
- supervising IMs	4,591	2.7%
IMs for conspiratorial assignments, thereof	30,446	17.6%
- informers responsible for the protection of conspiracy of communication, IMs with conspirator y apartments and in conspiratory objects	25,730	14.9%
- informers responsible for the protection of conspiracy of communication, IMs with cover addresses and cover telephones	4,716	2.7%
Social Informers for Security	33,354	19.3%
Total	**173,081**	**100%**

The threat of falling victim to a Stasi informant was immense and the sword of Damocles suspended over every social, political and economic transaction. The regime knew a number of possibilities for dealing with the independent-minded: denial of higher education, inability to achieve positions of leadership, discrimination in career and chosen profession, and restrictions on travel, publications, and assembly. Even death sentences were imposed until 1987 for a number of capital crimes.

In its arrogance the Ministry of State Security never reckoned with its own disbandment, and did not – contrary to all the rules of conspiracy – work out any concept for such an event. Thus, when the GDR collapsed in 1989 the Stasi "left behind extensive information, a mirror of [GDR] society from the perspective of an intelligence service, gigantic files, dossiers about private persons, mass organizations, political parties, institutions, official employees and unofficial informers" (Thaysen, 2000, p.752). Today, the Stasi records are an invaluable source for the systematic study of social capital erosion in oppressive regimes.

2.2   Implications and model motivation

Our description of the GDR as a despotic regime and its potential influence on social capital levels coincides with more general arguments and evidence presented in the literature according to which policies that assign authority to a

central agency to design and enforce rules can contribute to erode social capital. In fact, one of the oldest themes in economics is the incompatibility of despotism and development (DeLong and Shleifer, 1993, p.671). Both Smith (1776) and Montesquieu (1748) emphasize that where security over property is missing, development will be severely hampered. Or, as Adam Smith emphasizes, "where men are continually afraid of the violence of their superiors, they frequently bury and conceal a great part of their [capital] stock."

Ostrom (2005) argues that despotic or authoritarian policies deteriorate social capital by a) inducing individuals to be narrowly self-interested and to wait for externally imposed inducement of sanctions before voluntarily contributing to collective action, and by b) undermining citizens' ability to experiment solutions to their problems and learn form experimentation over time. Consistent with this argument, current institutional and organizational failures are often observed in regions that centuries ago were ruled by despotic governments, or where powerful elites exploited particular groups of the population (Tabellini, 2008). In such regions individuals typically mistrust others and display values and beliefs that are consistent with norms of limited morality. What is more, even if the country becomes a democracy, it retains weak institutions because "adverse cultural traits make citizens more tolerant of ineffective government" (Tabellini, 2008, p.938).

Aghion, Algan, Cahuc, and Shleifer (2009) look at the experiment of transition from socialism, which they interpret as a radical reduction in government control in low trust societies. Their model and empirical evidence shows that such reduction leads to *inter alia* a reduction in output and a reduction in trust in the short run. Finally, Algan and Cahuc (2007) describe that a prerequisite for the successful development of market economies would be to depart from closed group interactions and to enlarge exchanges to anonymous others.

That the phenomena and consequences of oppressive regimes described above might be validly expected to be observed in East Germany – as we hypothesize in this paper – can be illustrated with a simple map. Column 1 of Figure 1 shows the average surveillance intensity in the regions (*Bezirke*) of the former GDR as of the beginning of 1989. As is evident, the per capita concentration of Stasi personnel varied considerably across regions in the former GDR, and there is some indication of a southwest-northeast gradient, with relatively high numbers of unofficial informers per capita in the north, the northwest, and the east of the GDR, and comparably lower informer density in the south and in East Berlin.

In column 2 of Figure 1 we show variation in social capital, measured as the average electoral turnout at the German federal election in 2002 across the regions in East Germany. For better comparability, we choose to compute these statistics for the administrative units as they existed in the former GDR. As in column 1, a southwest-northeast gradient can be detected, indicating that potentially some relation between the intensity of secret police surveillance and regional levels of social capital exist. To be specific, voter turnout is highest in East Berlin and in the south – the regions which we also found to

have experienced the lowest Stasi penetration per capita under the communist regime. The rank correlation between regional surveillance density and social capital is $\rho = 0.47$.

Column 3 shows economic performance in East Germany, measured by the unemployment rate in 2007 for each region. Again, lowest unemployment figures are observed in East Berlin and the regions in the southwest. The rank correlation between regional social capital levels and economic performance is $\rho = 0.50$. To be sure, these charts allow only very circumstantial evidence for a relationship between severity of the regime's secret police apparatus, social capital and economic performance in East Germany. However, our initial observations clearly mandate further investigation of these relationships. In the subsequent section we therefore develop a formal model to help explain the potential relationship between surveillance intensity and social capital erosion in East Germany. Our model predictions are complemented by empirical evidence in Section 5.

Figure 1: Surveillance Density, Voter Turnout and Economic Performance in East Germany

This figure shows the surveillance density in the former GDR, the electoral turnout in East Germany, and the unemployment rate in East Germany. Regional clusters represent the 15 *Bezirke* of the former GDR. Surveillance density is calculated as the fraction of total number of unofficial collaborators active for the Stasi as of December 31, 1988 in its regional and district offices relative to the region's population (in thousand inhabitants). Electoral turnout is the region's average percentage voter turnout in the federal election of 2002. Unemployment rate is is the region's unemployment rate at the end of 2007 (in percent).

| Surveillance density | Social capital | Economic performance |
| (Informers per capita) | (Electoral turnout) | (Unemployment rate) |
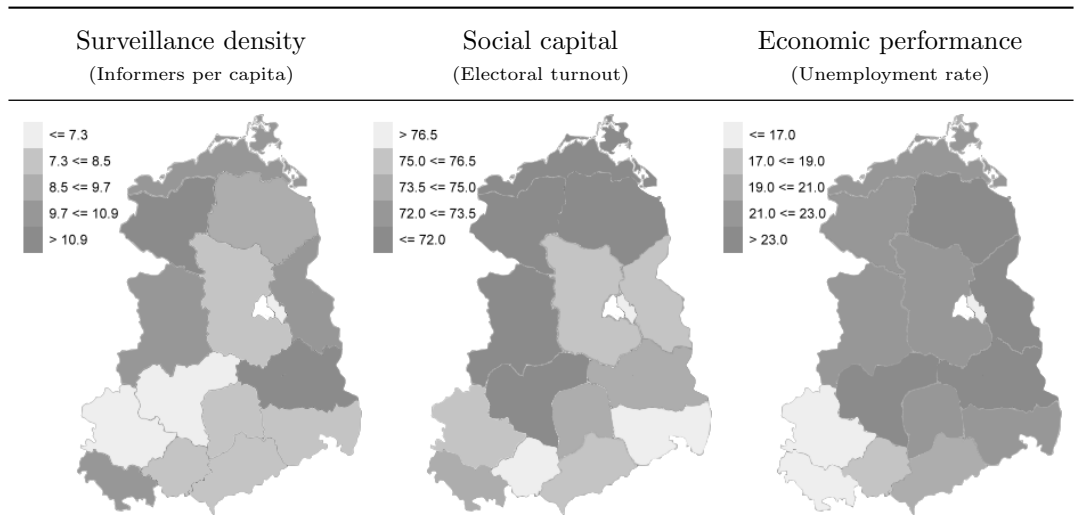
3 THE MODEL

3.1 The baseline model

We build our model applying a similar prior updating and transmission setup as Guiso, Sapienza, and Zingales (2008), but use the formal mechanisms underlying Rotating Credit and Savings Associations (Roscas) to simulate social

and economic interaction as a 'reciprocity game'. This allows us to adequately capture the disproportionally negative effect of informer activity on the level of trust and scope of cooperation within a society. Generalized reciprocity, so Putnam (2000) reminds us, is the touchstone of social capital. Indeed, formalizing central reciprocity mechanisms proves an ingenious way to analyze a bigger societal picture, for these mechanisms are so fundamental to civilized life and emblematic of any social or economic interaction which, directly or indirectly, involves many members and whose success is vulnerable to as little as one defecting member.[6]

In a typical Roscas setting a group of n individuals would each like to own an indivisible economic or non-economic good or service, which on their own they could not afford or perform. These members therefore commit to putting a certain economic (e.g. money) or non-economic (e.g. assistance, help or time) good or service into a "pot" for each period of life of the reciprocity game. Lots are drawn and the pot is randomly allocated to one of the contributors at the end of each period. In the next period the process repeats itself, except that the previous beneficiary (winner) is excluded from the draw for the pot. The process continues with every past winner excluded, until each member of the reciprocity game has received the pot once. At this point the game is either disbanded or begins over again. Imagine, for example, a group of 10 individuals who each contribute a monthly sum of US$ 10, and each year a different member receives that year's pot of US$ 1,200 to be used as he or she wishes (for example, to finance a wedding, a new car, etc.). That member is ineligible for subsequent distributions.

To illustrate the ubiquity of such reciprocity games in society, we can easily transfer this example to any non-monetary social or economic transaction that builds on reciprocity: a group of ten people are each confronted with major reconstruction work on their houses which on their own they could not perform. Therefore, those members agree to spend four weekends at each member's site to reconstruct that respective member's house (the order of which is randomly determined). If no member defects, then after 10 months all members have their houses reconstructed and the reciprocity game proved successful. Similar 'reciprocity games' can be found in political parties, youth groups, labor unions, charitable organizations, school societies, women's clubs, or athletic societies – in fact, reciprocity games, subtly or explicitly, underlie even the most basic and informal interactions in almost all aspects of social and economic life, from neighbors keeping an eye on one another's homes to friends supporting each other building their houses. Our interpretation of such reciprocity games therefore is one of a set of explicit, carefully delineated and concrete practices of mobilization and exchange of labor, of capital, and of consumption goods in every aspect of life.[7]

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[6]Recall, for example, that in every apartment building at least one informer served as a watchdog and reported all activities to the Stasi.

[7]This is very much in the spirit of Geertz's (1962, p.243) description of artisans, a form of Roscas in rural java, which are "commonly viewed by its members less as an economic institution than a broadly social one whose main purpose is the strengthening of community solidarity. The primary attraction of the arisan [...]

Clearly, reciprocity games as they are laid out above require trust and cooperativeness among their members, for there is a strong economic rationale for each receiver to default after receiving the pot. The fact that in such reciprocity games a certain share of defecting members has a disproportionately negative effect on overall economic outcomes is also an essential characteristic of an informer society.[8] To our knowledge, the transfer and application of formal Rosca mechanisms to the study of large scale intrusion of people's private lives and its effects on the intergenerational transmission of priors about cooperativeness and the scope of cooperation in a society is novel in the literature.

3.1.1 Prior transmission and types

As in Guiso, Sapienza, and Zingales (2008) our overlapping-generations model of prior transmission is in the following parameters. Each cohort lives three periods and comprises half of all individuals. Each member of cohort t in its initial period starts as a child and acquires its prior from the parents. In the subsequent period, each child (now an adult) decides whether to invest an endowment x in a project that has the characteristics of a reciprocity game. After investing, each individual updates her prior and transmits it to her children. In the third and last period, the individual (now mature) has another chance to invest based on the information in her possession. At the end of this period, each individual dies.

The economy is peopled with two types of agents, trustworthy individuals and informers. There is uncertainty concerning the fraction of the two types. In one environment (the "trustworthy" environment, $i = 1$) the trustworthy type predominates, and the share of informers is null or negligible; in the other environment (the "oppressive" or "informer" environment, $i = 2$), the trustworthy types are fewer and a significant fraction of the society are informers (in a later section of this paper we will draw on official numbers of informers per capita in the former GDR to simulate our model predictions). Individuals have a prior about the share p_i of informers in the society of size N. For the generation-t person, this prior probability distribution is as follows.

Table 2: Prior Probability Distribution

	"Trustworthy" environment (prior probability $\hat{\pi}$)	"Informer" environment (prior probability $1 - \hat{\pi}$)
Share of trustworthy individuals	$1 - p_1$	$1 - p_2$
Share of informants	p_1	p_2

Here $\hat{\pi}$ denotes the prior probability of being in the "trustworthy" environment.

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is the creation of [...] communal harmony [...] which occurs for example of [...] mutual assistance [...] which is demonstrated".

[8]E.g. in the example above, if only one member defects then this has a negative effect on 9 other individuals.
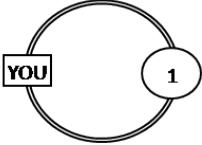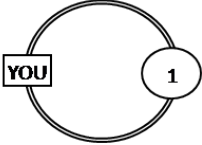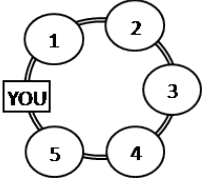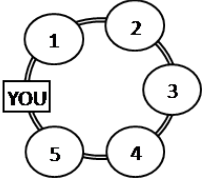
3.1.2 Economic and non-economic payoffs

Our model requires some straightforward assumptions. The first, innocuous, condition is that $R >> 1$, namely that a successful reciprocity game yields a positive return. We assume further that the good or service for which the group is formed does not depreciate and that each individual identically enjoys this good or service. To be specific, if an individual commits to a reciprocity game that contains n trustworthy members and no informer, then her overall benefit is $R = n^\delta x$, where x is the initial investment per Rosca period, n the number of members (and, hence, periods) to the reciprocity game, and $\delta > 1$ captures the idea that the return from the reciprocity game for any size n is greater than the investment nx. $\delta > 1$ further implies that the more members there are to the social or economic interaction the greater is the expected return when no member defects. One can think of reciprocity games with more members as yielding more of both economic and non-economic (psychological) benefits. This captures two central ideas. First, reciprocity games, as other forms of social networks, increase with use and diminish with disuse. Second, besides obtaining a material payoff, each individual enjoys a non-economic (psychological) benefit whenever she ventures in a reciprocal game. Allowing for non-economic benefits captures the idea that individuals are motivated by more than just material payoffs. They also have social needs they seek to satisfy and value the act of cooperating per se (Andreoni, 1990).

In line with the basic principles underlying Roscas, we assume that if a reciprocity game (regardless of size) contains one or more defecting members (informers), then an individual receives a *zero* return from the the reciprocity game. For analytical tractability, throughout this paper we will further assume that already in the first period of the game individuals will perfectly learn whether or not their reciprocity game contains defecting members. This simplification is motivated by the fact that an informer can be assumed to report the group's activities as soon as the group's activities commence, which leads to dissolution of the group.[9] In our model, this assumption biases our results towards more social and economic interaction, and greater size n of reciprocity games.

Figure 2 presents two examples which illustrate the payoff mechanism underlying our model. The examples show how a greater share of informers disproportionally reduces the likelihood of a successful reciprocity game when the number of members increases.

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[9]And possibly even to detention of its members, depending on the group's activities. Imagine, for example, a group that plans to cross the border illegally.

Figure 2: Exemplary Reciprocity Games – Returns and Probabilities of Success

Society with fraction of informants $p = 0.1$	Society with fraction of informants $p = 0.3$
Reciprocity game with 1 member	Reciprocity game with 1 member

Likelihood of success: $(1 - 0.1)^1 = 0.9$ Payoff if successful: $R = 1^\delta x$	Likelihood of success: $(1 - 0.3)^1 = 0.7$ Payoff if successful: $R = 1^\delta x$
Reciprocity game with 5 members	Reciprocity game with 5 members

Likelihood of success: $(1 - 0.1)^5 = 0.59$ Payoff if successful: $R = 5^\delta x$	Likelihood of success: $(1 - 0.3)^5 = 0.17$ Payoff if successful: $R = 5^\delta x$

3.1.3 Learning

By investing, an individual learns more about the true distribution of informants in the population – information that she can use in subsequent decisions and that she can transmit to her children. Each investor gets a random draw from the true distribution and then updates accordingly. Appendix A.2 has the details on our prior updating mechanism based on Bayes' theorem.

By contrast, we assume that if an individual does not invest then she will not learn. As Guiso, Sapienza, and Zingales (2008) explain, this assumption may seem extreme, because people learn not only from direct experience but also from the experience of others. This latter channel, however, is generally weaker and particularly so when people lack trust. Hence, it is not unreasonable to assume that non trusting people find it difficult to learn from the outside environment (see also Guiso, Sapienza, and Zingales, 2009).

3.1.4 Returns

In our setup, individuals face an important decision concerning their scope of cooperation, namely which size n of reciprocity game to choose. While return is positive in the number of members, a greater number of members also disproportionally increases the likelihood of running into a defecting member (informer). Under the assumption of a large population N and $n << N$, it is easy to see that the probability of success of a reciprocity game is

$$(1 - p_1)^n. \tag{1}$$

Note again that the return from an unsuccessful reciprocity game is zero and individuals will learn about presence or absence of defecting members in the group in the first period of the game (after investing x). Then the expected payoff from a reciprocity game is

$$P_i(p_i, n, \delta) = n^\delta (1 - p_i)^n x - x. \tag{2}$$

This lets us establish some technical properties about the optimal size n of the reciprocity game, summarized in the following lemma.

LEMMA 1: Under the assumptions set out above and for $n^\delta(1-p_i)^n \geq 1$ (i.e., the individual invests), the expected total benefit $P_i(p_i, n, \delta)$ from the reciprocity game in one specific environment is a concave function of n. The optimal size n of the reciprocity game depends only on δ and p_i, and for each $0 \leq p_i \leq 1$ and $\delta \geq 1$ there exists a unique $n_i(p_i, \delta)$ that maximizes an individual's return from the reciprocity game given by the following expression (the proof is in Appendix A.3):

$$n_i = -\frac{\delta}{\ln(1 - p_i)}. \tag{3}$$

Note that n_i is strictly decreasing in p_i. If we interpret size n_i of our reciprocity game similar to the distance y in Tabellini (2008) and Dixit (2004), it becomes clear how the Rosca mechanism enables us to study the direct relationship between surveillance intensity in a society and the scope of cooperation: $n_i(p_i, \delta)$ captures the scope of cooperation in a society as a function of the density of informer activity. A large scale and depth of the penetration of people's lives as well as of the institutions of state and society may lead to a strong reliance on transactions within the immediate family ("amoral familism") as opposed to transactions with unknown, more distant third persons. As a result, the "amoral familism" that Banfield (1958) observed in the Mezzogiorno may, in fact, be not irrational but the only rational strategy for survival in a society that is characterized by a highly intrusive state security body as in the GDR.

Now let us turn to the expected payoffs. Ex ante, an individual expects to observe p_1 with probability $\widehat{\pi}$ and p_2 with the complementary probability $(1 - \widehat{\pi})$. And based on this expectation the individual must ex ante choose an optimal size $\widetilde{n}$ of the reciprocity game that maximizes her expected payoff. Let $A = \widetilde{n}^\delta (1 - p_1)^{\widetilde{n}}$ denote the expected return if the members to the reciprocity game are drawn from the "trustworthy" population and $B = \widetilde{n}^\delta (1 - p_2)^{\widetilde{n}}$ the expected return if the members are drawn from the "informer" environment. Clearly, whether $A > 1$ and $B > 1$ depends critically on the share of informers (p_i) in the two environments and the size n of the reciprocity game chosen. However, under the assumption that $p_1 << p_2$ it follows for any n that $A >> B$, so the expected return is positive and much greater if the population is "trustworthy" than if it is plagued by a high intensity of spying activity. Finally, an individual with a prior that is unfavorable to investment may still find a small-n reciprocity game attractive enough because it has a positive expected

return even for a small given $\widehat{\pi}$. Hence, a "pessimistic" prior reduces the scope of cooperation. A sufficiently pessimistic prior may even lead to no investment at all.

At the beginning of the first period individuals will choose n such that they maximize their expected first-period return given by:

$$P(\widehat{\pi}, p_1, p_2, n, \delta) = \widehat{\pi} \left(n^\delta (1 - p_1)^n\right) x + (1 - \widehat{\pi}) \left(n^\delta (1 - p_2)^n\right) x - x = (\widehat{\pi} A + (1 - \widehat{\pi}) B) x - x. \quad (4)$$

This equation enables some conclusions to be drawn for the optimal size $\widetilde{n}$ of the reciprocity game chosen by individuals who are uncertain about the true share of informers in a society. First, individuals will invest in reciprocity games unless the expected payoff is smaller than 1 (and the expected return after investment x falls below zero). Second, it can be shown that under the specification chosen in Equation 4 people will always either opt for scope of cooperation n_1 (the optimal size n in the 'good' world) or n_2 (the optimal size n in the informer society). Choosing n such that $n_2 < n < n_1$ is always strictly inferior to choosing one of the optimal values n_1 or n_2. To be specific, people choose scope of cooperation n_1 until their priors are sufficiently depressed and choosing n_2 becomes the preferred option. (The threshold prior $\overline{\pi}$ below which n_2 becomes the preferred scope of cooperation is in Appendix A.4.) Consequently, in our model, the more optimistic individuals' priors in a society are (that is, the greater their $\widetilde{\pi}$) the greater will be their scope of cooperation. Conversely, where people have a greater reason to believe that they live in an informer environment (that is, they have a greater $1 - \widetilde{\pi}$) their scope of cooperation is more limited on average.

Consider next the second-period decision. If an individual has not invested in the first period, then she will not invest in the second period because no new information was accrued. Thus, the interesting case is the one where an individual has invested in the first period in a reciprocity game of size n. Because investing allows investors to learn more about the true distribution of types, the expected return in the second period will depend only on the individuals' success of the reciprocity game, which in turn depends on the true share of informants (p_i). An individual who in the first period finds his reciprocity game successful will have an updated prior $\pi > \widehat{\pi}$ (see Appendix A.2), and in the second period she will invest in at least a same size-n reciprocity game. But if she experiences a defected reciprocity game and has sufficient reason to believe that she lives in a highly infiltrated society (that is, $\pi < \overline{\pi}$) then in the second period she will invest only in a smaller-n reciprocity game.

This illustrates the important model dynamic. The more often the experience from these social experiments is frustrating for individuals the more downward they will correct their priors about the trustworthiness of the society, and as a result their scope of cooperation in social and economic interactions ultimately collapses. Conversely, the more often individuals make positive experiences in reciprocity games, the more optimistic will their priors about the trustworthiness of the society become, and as a result the scope of cooperation expands.

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3.1.5 The parent's prior transmission

A parent passes on to her child all her available knowledge about the true degree of informer activity in the society. In other words, the parent's experiences from social and/or economic transactions in the first period will become knowledge fully accessible by the child. A parent does so by transmitting her posterior π_P which becomes the child's prior $\widehat{\pi}_C$. This implies that both parent (then in her second period) and child (then in her first) engage in social or economic interactions based on the same belief about the trustworthiness (or, informer density) of the society. This model implication coincides with evidence presented by Dohmen, Falk, Huffmann, and Sunde (2006) who use data from the German Socio-Economic Panel (SOEP), a representative panel survey of the resident German population, to show a strong and robust correlation between the trusting behavior of parents and their children.[10]

4 MODEL SIMULATIONS AND IMPLICATIONS

To check our theoretical predictions of a significant negative relationship between the pervasiveness of the network of informants and social capital, we use actual data on the informer density in the GDR and simulate our model in MatLab. All simulations involve 20 generations (about 500 years assuming a generational gap of 25 years). Each generation is composed of 500 people. As in the real case of East Germany, we specify our model such that in the first three generations the true regime is the oppressive regime with share of informants p_2. In generations 4-20 we make the democratic society the true environment. We assume that the number of informers is negligible in a democratic society, and that the first-generation prior is diffuse (both society types are equally likely).[11]

Figure 3 illustrates the outcome of the basic principle underlying our model. If the informer environment is the true world then for positive or insufficiently negative priors (that is, $\pi > \overline{\pi}$) individuals will perceive larger size-n_1 reciprocity games optimal, for these transactions offer superior expected returns. However, scope of cooperation n_1 is an inappropriately high choice if the true world is the "oppressive" environment, because with almost perfect certainty

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[10]Note again that in our model we use Bayes' theorem to calculate individuals' posterior probabilities. One could apply an even stronger prior updating rule according to which individuals following negative reciprocity experiences in an informer society correct their priors as far down as below the threshold prior $\overline{\pi}$ such that they and their children in the future always prefer the narrow scope of cooperation n_2 ('amoral familism'). The results presented in the subsequent section should thus be considered upper boundaries for the priors about the trustworthiness of others and the scope of cooperation in a society.

[11]In this section we make rather conservative assumptions about the initial prior $\widehat{\pi} = 0.5$. One might argue that when the oppressive regime was installed individuals immediately had an above average understanding of the existence of the regime's secret service and methods of repression. Similarly, events such as the violently suppressed uprising of June 17, 1953 against the Stalinist German Democratic Republic or the construction of the Berlin Wall may have contributed to deterioration of people's priors about the trustworthiness of the society they lived in. The priors and the scope of cooperation simulated in our model can thus be considered upper boundaries of the true cooperative nature of the society in the former GDR. Lower initial levels of priors $\widehat{\pi}$ result in three important model outcomes: a) earlier collapse of the scope of cooperation under the oppressive regime, b) a lower post-collapse scope of cooperation, and c) longer time to prior recovery under democracy.

individuals will encounter informers. This way, as individuals play and make repeated negative experiences their priors will ultimately fall below the prior threshold $\widehat{\pi}$ for which it is better to play the narrow scope n_2 reciprocity game.

Figure 3: Simulating the Effects of Three Generations Under an Oppressive Regime and Subsequent Democratization on Average Priors and the Scope of Cooperation

Panel A: $\widetilde{\pi} = 0.5$, $N = 500$, $\delta = 1.1$, $p_1 = 0.0001$, $p_2 = 0.0055$, $x = 1$
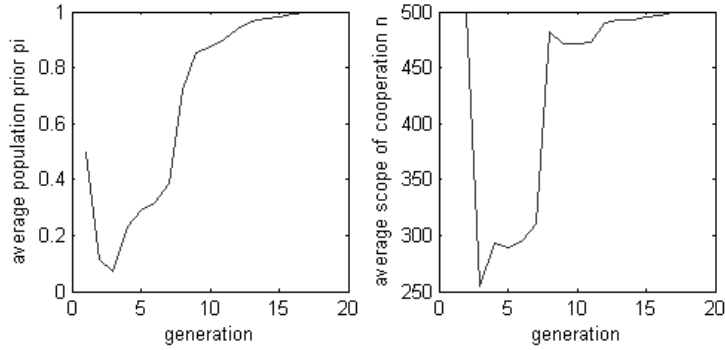
Panel B: $\widetilde{\pi} = 0.5$, $N = 500$, $\delta = 1.1$, $p_1 = 0.00001$, $p_2 = 0.0158$, $x = 1$
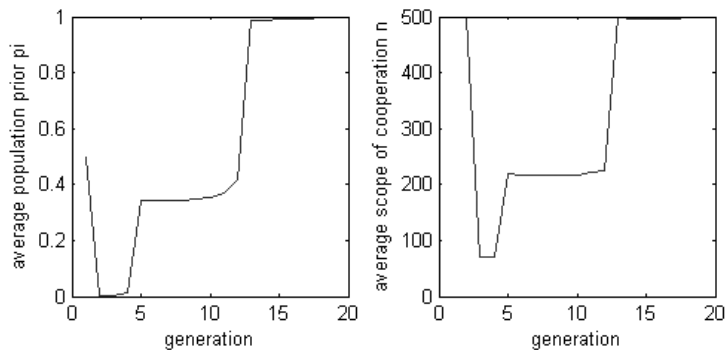
In Panel A of Figure 3 we take into account only the 91,015 full time Stasi officers in the GDR and simulate the priors about trustworthiness and scope of cooperation for an informer density of $p_2 = 0.0055$ (91,015 officers on a population of 16.675 million). Our model predicts that the scope of cooperation collapses in the third generation under the oppressive regime and only gradually recovers under democratic institutions. To be specific, the scope of cooperation recovers by approximately 20% in the first generation after democratization but takes another 4 generations to reach pre-regime-shock levels. This is for a simple reason. After democratization, individuals only gradually build up their priors about the trustworthiness of others, since they initially continue to commit only to social and economic interactions that are very narrow in scope and thus allow only for a limited learning effect. By successfully playing, on

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average, increasingly larger size-n reciprocity games after the oppressive regime shock, average trustworthiness is gradually built as individuals make repeated positive experiences in increasingly sizeable reciprocity games.

In Panel B of Figure 3 we increase the surveillance intensity by additionally including the 173,081 regular Stasi informers, leading to an informer density of $p_2 = 0.0158$. The higher density of secret police activities leads to a much narrower scope of cooperation than in Panel A after collapse of cooperativeness in the third generation under the oppressive regime. In fact, in this scenario priors depress so much that the positive initial small n_2 scale transaction experiences in the generation immediately after democratization do not suffice to push priors above the threshold $\overline{\pi}$ that make large scale cooperation attractive. This ultimately occurs in generation two after democratization when cooperation significantly expands. Our model suggests that scope of cooperation and priors about trustworthiness reach their ideal levels only in a later generation than in Panel A.

In sum, the most important implications from our model for East Germany are threefold. First, the greater the degree of infiltration of society, p_2, the more strongly priors about the trustworthiness of others erode and the longer is the times it takes until trust and cooperation recover. At the same time, the greater p_2 the more profound and large-scale recovery is when it finally occurs. This is because the greater is the informer density in a society prior to democratization the more informative of the presence of an informer-free society is the observation of no defecting members in a reciprocity transaction post democratization.

Second, priors about trustworthiness and the scope of cooperation are unlikely to be stuck in a low trust, low cooperation equilibrium. Rather, priors and cooperativeness will ultimately recover. However, third, absent positive external shocks our results indicate that it could probably take up to another three generations until the scope of cooperation in East Germany reaches the level characteristic of the West. This gradual recovery of the scope of cooperation captures another important aspect of the post GDR society. After democratization, the individuals that used to snoop on neighbors, club members, friends, etc. did not cease to exist as did the official administration they reported to. Rather, accessible personal Stasi files, word of mouth and official investigations have led to the unmasking of former Stasi informers. In this current generation, many individuals may find the expansion of their scope of cooperation to include (alleged or confirmed) ex-members of the Stasi particularly difficult.

5 EMPIRICAL EVIDENCE

In this section we use empirical evidence to test the above model implications, as well as our central conjecture that the density of regular Stasi informers is positively related to the erosion of social capital. We present our results in two steps. First, we use multiple regression analysis to investigate the relationship between informer density and social capital, and we test the robustness of

our results to reverse causality concerns, and alternative measurement and specification strategies. Second, drawing on the results from the first stage, we employ instrumental variable regressions to establish whether a relationship between contemporary levels of social capital and economic performance in East Germany can be detected.

Figure 4: District Administrative Offices and District Offices of the MfS 1989

This figure shows the location of the district administrative offices and local offices of the Ministry of State Security (MfS) in the former GDR. Locations of district administrative offices are marked as black squares. Local offices are highlighted in gray circles. Black diamonds indicate locations of Stasi site offices at factories and other important installations and facilities.

Our central explanatory variable is the surveillance intensity at the district level across the districts in the former GDR. As Figure 4 illustrates, besides a central headquarter in Berlin the Ministry of State Security maintained a local presence with 15 regional administrations, 209 district offices, and 8 site offices at factories and other important installations and facilities.

We measure surveillance density as the fraction of unofficial Stasi informers active in the district relative to the district population (in thousand people) in 1989.[12] District level population data for 1989 are available from the Statistical Yearbook of the GDR (Statistisches Amt der DDR, 1990). To obtain

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[12]The Ministry of State Security's secret police apparatus comprised two types of personnel – regular Stasi informers (or, unofficial collaborators) and full-time Stasi officers. We draw on density of regular informers in this study, for it is in particular the day to day surveillance and direct interaction between surveillor and surveillee through which our hypothesized mechanism (see Section 3) works. Also, only about 10% of all Stasi officers but approximately 50% of all regular Stasi informers were active at the district level (Giesecke, 2000). Primarily regular informers rather than Stasi officers were responsible for day to day surveillance. They reported to Stasi officers at the regional level. Unofficial Stasi informers were thus considered the most powerful surveillance apparatus, because they worked undercover and thus gained access to individuals, groups and their activities to which official Stasi officers would not have had unnoticed access to.

surveillance intensity data we collect and code information on the official number of informers active at the district-level. The data are from Müller-Enbergs (2008), a researcher for the Federal Commissioner for the Records of the State Security Service of the Former German Democratic Republic (*BStU*) and the main expert on the topic. Data are available for the majority of districts in the former GDR. As alluded to in Table 1 above, the Ministry of State Security distinguished seven types of informers at the district level. Those were: 1) informers to safeguard areas of responsibility, 2) informers with enemy contact, 3) expert IMs, 4) supervising IMs, 5) informers responsible for the protection of conspiracy of communication, IMs with conspiratory apartments and in conspiratory objects, 6) informers responsible for the protection of conspiracy of communication, IMs with cover addresses and cover telephones, and 7) citizens temporarily or permanently collaborating with the Ministry of State Security (social informers for security). To avoid potential bias, we include in our analysis only those 147 of the 227 districts for which information for all seven informer categories was available.[13]

5.1 Surveillance intensity and social capital

5.1.1 Dependent variables

Our initial focus is on the influence of secret police surveillance in the former GDR on current levels of social capital in East Germany. Our dependent variable in this stage of our analysis is the level of social capital at the district level. Since we are interested in measuring people's propensity to cooperate for reasons other than standard economic incentives, we focus on three measures of civic spiritedness that are hardest to explain with self-interested agents: electoral participation, sports club membership, and cadaveric organ donations. The first and the third measure, in particular, rely critically on purely "altruistic" behavior and indicate a level of caring about the social community. As such they are the least likely to be generated by other economic motivations which may have some spurious effects (Guiso, Sapienza, and Zingales, 2004, p.7). All our measures of social capital possess two other important features. First, they require active civic involvement. Current scholarship on social capital (Walzer, 1974; Putnam, 1993) emphasizes that citizenship in a civic community is marked, first of all, by active participation in public affairs, interest in public issues and devotion to public causes. Second, our choice of electoral turnout, sports club membership, and organ donations as proxies for social capital is informed by the fact that these measures cover three very distinct dimensions of civic involvement and thus provide for an inbuilt control mechanism. For example, it could be argued that electoral turnout measures not only social capital but may also contain characteristics of the post communist society such as individuals' attitudes towards democracy. Using measures

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[13]Numerous secret police files were destroyed by the Ministry of State Security when the regime collapsed so that naturally the district coverage in Müller-Enbergs (2008) is imperfect. We confirm the robustness of our results to exclusion of 80 districts in Section 5.1.5.

of social capital on different dimensions of civic involvement addresses such concerns.

We measure our social capital variables as follows. First, we use the district-level percentage electoral turnout in the German federal election in 2002.[14] Our second dependent variable is the total membership in sports clubs relative to the district population (in thousand people) in 2007. Our third measure is people's willingness to donate organs post mortem, measured as the fraction of organ explantations in the district relative to the district population (in thousand people) in 2005. Information on voter turnout and sports club membership is available from the German Federal Statistics Office (*Destatis*) and the Statistical Yearbook of the German Districts (*Statistisches Jahrbuch Deutscher Gemeinden*, 2007). Data on organ donation activity is obtained from the German Organ Transplantation Trust (*Deutsche Stiftung Organtransplantation*, DSO). In Germany, organ donations and transplantations are organized and administered solely by the DSO. Hence, the DSO tracks all organ donations in Germany. The number of cadaveric organ donations is a powerful measure of social capital in its own right. This is because nondonors have been found to demonstrate a remarkable lack of trust in the fairness of organ allocation, as well as a lack of belief that donation is for the common welfare (Peters, Kittur, McGaw, First, and Nelson, 1996).

Figure 5 plots the relation between surveillance density on the x-axis and our three measures of social capital on the y-axes for all districts in our sample (Panel A) and for a sub-sample of districts which in the former GDR had a border with another country (Panel B). This additional geographical focus on border districts is useful for a reason. For the communist regime security of the country's borders and prevention of flight from the GDR was of utmost importance. As in border districts the presence of Stasi informers was thus generally greater and surveillance activity thus particularly consequential for people's lives, we expect that this is where our hypothesized relation between surveillance and social capital can be observed with the least noise.

The strong negative relation between surveillance density and our social capital measures in Figure 5 is striking. For our electoral turnout measure in the border districts sub-sample, in particular, the individual observations cluster remarkably tightly around the negative trend line. This is indicative evidence of a negative impact of Stasi surveillance activity in the former GDR on current levels of social capital in East Germany. The negative relation between surveillance and social capital is weakest for our organizational membership measure.

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[14]We use electoral participation data from 2002 and not from the more recent federal election in 2005, because the federal election in 2005 was preponed and became necessary after a motion of confidence in Chancellor Gerhard Schröder had failed in parliament. Thus, it can be argued that the 2005 election was in some respects special and potentially contains idiosyncratic effects. We use turnout data for 2005 to check the robustness of all our results obtained for 2002, and the results are very similar.

Figure 5: Surveillance Density and Social Capital

This figure displays the relation between surveillance intensity in the districts of East Germany on the x-axes and three social capital indicators on the y-axes. Panel A reports scatter plots and trend lines for all district in the sample. Panel B shows scatter plots and trend lines for the reduced sample that contains only border districts. The social capital indicators are as follows. The first is the district-level electoral turnout in the German federal election. The second is the total membership in sports clubs relative to the district population (in thousand people). The third is the fraction of the number of organs donated in the district relative to the district population (in hundred thousand people).

Panel A: All districts

Electoral turnout   Sports club membership   Organ donations
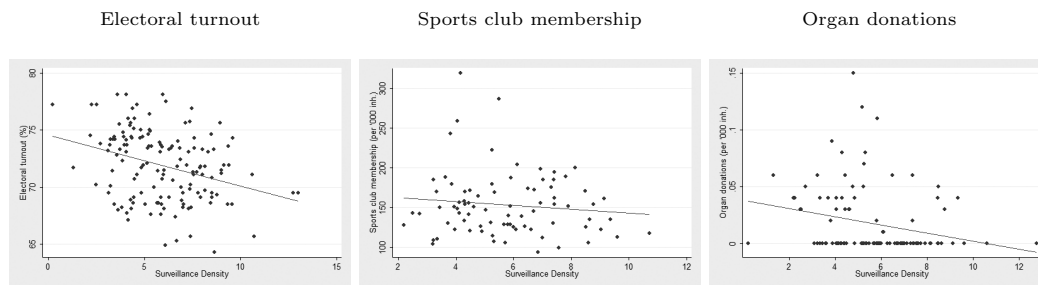
Panel B: Border districts

Electoral turnout   Sports club membership   Organ donations
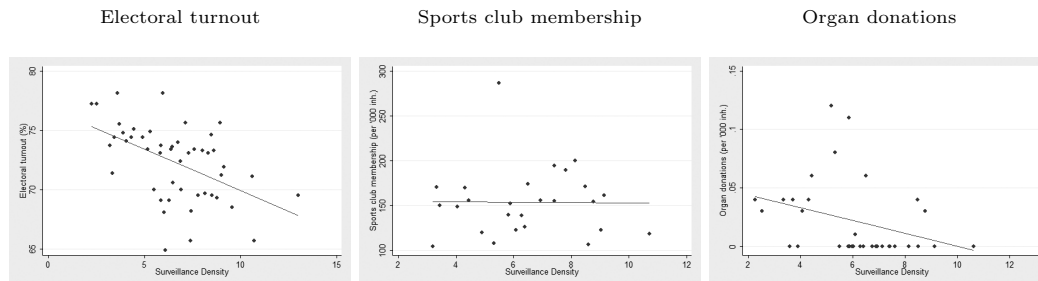
5.1.2 Explanatory variables

As a next step, we use multiple regression analysis to substantiate the significance of the negative relationship between informer density and social capital detected in Figure 5. After all, the relationships displayed in Figure 5 may suffer from unobserved heterogeneity that infects our results.

Our central explanatory variable is the surveillance density (*Surveillance*) in the districts in the former GDR as described above. We also add independent variables which control for alternative explanations for differences in social capital across districts.[15] Those are obtained from Destatis and are fivefold. First, some authors have indicated that size of the community makes a difference: formal volunteering, informal helping behavior, charitable giving, and also blood donations were all found to be more common in small towns than in big cities (see, for example, Korte and Kerr, 1975, House and Wolf, 1978, Ste-

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[15]In Germany, sufficiently disaggregate data for the purposes of our study are often reported only infrequently or with a substantial delay. Also, some data series are no longer published by the German Federal Statistics Office. Our data therefore unavoidably source from multiple years.

blay, 1987, and Piliavin, 1990). Therefore, as our first control (*Population*) we add the district level population (in thousand people) in 2007. As our second control, we include variable *Area*, which is defined as the size of the district in hundred square kilometers in 2007.

Third, prior scholarly work suggests that social capital levels may differ depending on the degree of urbanization of a region (cf. Putnam, 1993). More rural, less anonymous districts may create a greater sense of belonging to a community and thus breed trust and cooperation. Unsurprisingly therefore, some theories see civic virtue in traditional villages and vice in the city. Our measure of *Urbanization* is population density, measured by the district population relative to the territorial area in hundred square kilometers at the end of 1989. Using population density in 1989 as a measure of urbanization has an important advantage. It addresses the concern that surveillance intensity per capita may spuriously pick up population density characteristics which, in turn, are related to our measures of social capital and economic performance, thus causing a false positive conclusion that current social capital patterns and economics are affected by surveillance intensity differences across East German districts.[16]

Fourth, our reading of the social capital literature yielded that social capital might be influenced by human capital out-migration and residential stability. Glaeser and Redlick (2009) emphasize that social capital is often place-specific, so the prospect of out-migration may reduce the returns to social capital and thus the local stock of civic spiritedness. As a result, we collect the percentage of the average annual net migration across district borders for 2000-2005 relative to the district population (in thousand people) in 2000 (*Migration*). Negative values of Migration indicate net out-migration. Similarly, Putnam (2000) suggests that because it takes time for a mobile individual to put down new roots, residential stability should be strongly associated with civic engagement. According to this argument, demographic instability may dissolve social solidarity and disrupt existing norms and community ties. Evidence presented by Sampson (1988) confirms that communities with higher rates of residential turnover are less well integrated, and so mobility undermines civic engagement and community-based social capital. To control for a potential residential instability effect we also insert the square of Migration, $Migration^2$.

Fifth, we control for the quality of education at the district level, since education may play an important role strengthening the foundations of the civic community. In fact, Putnam (2000) conjectures that education is one of the most powerful predictors – usually even the most important predictor – of virtually all forms of altruistic behavior. College students, for example, are found to be twice as likely to be blood donors. We measure *Education* as the percentage of the district population aged 18 to 29 that graduated from school in 2007 with a degree that qualifies for tertiary education.

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[16]When we use population density in 2007 as our Urbanization measure the results are very similar to those reported for all subsequent analyses, and the statistical significance of our surveillance measure in many cases increases.

Finally, Putnam (2000) shows that religious involvement is a critical dimension of civic engagement. Churches are a central social institution and provide the organizational and philosophical bases for the development of social connections. At the same time, summary statistics in Appendix A.1 show that religiosity differs substantially across East Germany. As a result, we control for religiosity in the districts in our sample. We do so by using *Protestant* and *Catholic*, which measure the percentage of the population that is Protestant and Roman Catholic, respectively. Data on religiosity at the district level in Germany is generally not readily available and we have to rely on a special analysis performed by the German Federal Statistics Office. 2001 is the latest year for which this analysis has been undertaken.

In general, combining historical and current characteristics of districts as we do in our analysis can be problematic. Current districts are only rarely within their 1989 borders, because several territorial reforms since 1990 have reshaped Germany's local administrative structure. Therefore, we adjust all our data for redistricting. To ensure best possible congruence between historical and current districts we assign each former GDR district the current district with which it shares the greatest fraction of its territory. Summary statistics of all variables are available from Appendix A.1.

5.1.3 Results

Table 3 presents the results from our regressions for the relationship between surveillance intensity and current social capital in the districts in East Germany. In these regressions we use robust standard errors clustered by region to explicitly account for the cross correlation of error terms across districts within the same region. The dependent variable in columns 1-2 is the percentage electoral participation. In columns 3-4, the dependent variable is the number of members in sports clubs relative to the district population (in thousand people). The dependent variable in columns 5-6 is the fraction of the number of organs donated in the district relative to the district population (in thousand people).

The results in Panel A are noteworthy. For all three measures of social capital we find a statistically significant and negative relation between surveillance density and social capital. This is strong confirming evidence for our central conjecture that the scale and depth of penetration of people's private lives, as well as of the institutions of state and society in the GDR, has a lasting effect on social capital in East Germany even one generation after the oppressive regime's collapse. The results are not only statistically but also substantively significant. A one standard deviation increase in Stasi informer density (about 2.73 informers per thousand people) is associated with a 0.6 percentage point decrease in electoral turnout[17], and a decrease of 16 members in sports clubs per thousand people – or 10% of the sample mean. Similarly, a one standard

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[17]Statistical significance and absolute effect of surveillance intensity on electoral turnout is even stronger when we use electoral participation data from 2005.

Table 3: Surveillance Density and Social Capital

This table shows estimates of the effect of Stasi surveillance intensity in the districts of the former GDR on current levels of social capital in East Germany. Panel A reports non-weighted OLS estimates. Panel B reports non-weighted OLS estimates with federal state fixed effects. Panel C shows OLS estimates based on observations weighted by the relative similarity between current and historical district territory. The dependent variable in columns 1-2 is the percentage electoral turnout in the German federal election. In columns 3-4, the dependent variable is sports club membership relative to the district population (in thousand people). The dependent variable in columns 5-6 is the fraction of the number of organs donated in the district relative to the district population (in thousand people). Robust standard errors clustered by regions are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively. $Constant$ is the intercept of the regression equation. $Surveillance$ is the fraction of Stasi informers active in the district relative to the district population (in thousand people). $Population$ is the district population (in thousand people). $Area$ is defined as the size of the district in hundred square kilometers. $Urbanization$ is the population density, measured by total district population relative to the territorial area in square kilometers. $Migration$ is defined as the percentage of the average annual net migration across district borders relative to the total district population. $Migration^2$ is defined as the square of $Migration$. $Education$ is the percentage of the district population aged 18 to 29 that graduated from school with a degree that qualifies for tertiary education. $Protestant$ is the percentage of the population that is Protestant. $Catholic$ measures the percentage of the population that is Roman Catholic. $Observations$ is the number of districts for which all information was available. $R-squared$ is the coefficient of determination of the equation. $F-test$ is the F statistic and indicates the significance of the equation. $Fed. states$ indicates that regional fixed effects in the form of federal state dummies are included.

Panel A: Ordinary least squares

	Electoral turnout		Sports club membership		Organ donations	
Constant	74.5460***	71.8564***	166.8966***	196.7095***	0.0378***	0.0083
	(1.5987)	(2.1042)	(14.0014)	(39.0082)	(0.0081)	(0.0210)
Surveillance	-0.4454**	-0.2271**	-2.5379	-5.8122**	-0.0036**	-0.0037**
	(0.1829)	(0.0821)	(2.0553)	(2.8509)	(0.0014)	(0.0015)
Population		-0.0074		-0.2085		-0.0001
		(0.0060)		(0.1260)		(0.0001)
Area		0.1180		-0.3273		0.0023**
		(0.1427)		(2.7627)		(0.0010)
Urbanization		0.0015*		0.0093		0.0000**
		(0.0007)		(0.0116)		(0.0000)
Migration		2.2140***		6.3463		0.0150
		(0.4645)		(20.4826)		(0.0085)
Migration^2		0.9177*		5.8888		0.0145**
		(0.4689)		(11.3714)		(0.0055)
Education		-0.7274		6.3925		0.0031
		(0.4068)		(5.9521)		(0.0027)
Protestant		0.1668***		-1.1996*		0.0008*
		(0.0485)		(0.6304)		(0.0004)
Catholic		0.1115***		-0.1075		-0.0001
		(0.0159)		(1.2251)		(0.0001)
Observations	144	134	82	82	108	100
R-squared	0.10	0.55	0.01	0.15	0.06	0.22
F-test	5.93**	30.61***	1.52	1.24	6.78**	98.67***

Panel B: Federal state fixed effects

	Electoral turnout		Sports club membership		Organ donations	
Constant	76.3621***	66.4622***	173.8071***	226.7917***	0.0324***	-0.0065
	(0.1755)	(1.7439)	(10.9296)	(54.3845)	(0.0053)	(0.0363)
Surveillance	-0.1166*	-0.1663***	-3.2974*	-5.7403*	-0.0042**	-0.0040**
	(0.0598)	(0.0525)	(1.8037)	(2.6379)	(0.0018)	(0.0016)
Population		-0.0032		-0.1662		-0.0001
		(0.0035)		(0.1258)		(0.0001)
Area		-0.0373		-1.3879		0.0028**
		(0.1121)		(3.3916)		(0.0012)
Urbanization		0.0005		0.0047		0.0000**
		(0.0003)		(0.0087)		(0.0000)
Migration		1.5673***		10.4109		0.0148
		(0.3845)		(17.9351)		(0.0100)
Migration^2		0.4565*		11.0113		0.0136*
		(0.2349)		(15.1100)		(0.0073)
Education		0.7325		1.7832		0.0068
		(0.4109)		(12.2302)		(0.0072)
Protestant		0.0546*		-1.3651		0.0008*
		(0.0259)		(0.9700)		(0.0004)
Catholic		0.0511**		-2.1344		0.0001
		(0.0182)		(1.6871)		(0.0002)
Fed. States	Yes	Yes	Yes	Yes	Yes	Yes
Observations	144	134	82	82	108	100

Table 3: *Continued*

	Electoral turnout		Sports club membership		Organ donations	
R-squared	0.73	0.78	0.11	0.18	0.14	0.27

Panel C: Weighted least squares

	Electoral turnout		Sports club membership		Organ donations	
Constant	74.1587***	71.7504***	163.1801***	187.0075***	0.0395***	0.0056
	(1.4376)	(2.2712)	(12.6028)	(38.2436)	(0.0088)	(0.0235)
Surveillance	-0.3788**	-0.2513**	-2.0598	-5.3703**	-0.0036*	-0.0035*
	(0.1678)	(0.0865)	(1.8674)	(2.6152)	(0.0016)	(0.0017)
Population		-0.0082		-0.2082*		-0.0001
		(0.0064)		(0.1165)		(0.0001)
Area		0.1390		0.8733		0.0025**
		(0.1118)		(2.2300)		(0.0008)
Urbanization		0.0016*		0.0103		0.0000**
		(0.0008)		(0.0112)		(0.0000)
Migration		2.2729***		8.1484		0.0135
		(0.4953)		(18.9999)		(0.0090)
Migration^2		1.0403**		5.7861		0.0137**
		(0.4447)		(9.8429)		(0.0055)
Education		-0.6743		6.9747		0.0043
		(0.4128)		(5.4824)		(0.0027)
Protestant		0.1724***		-1.0580*		0.0007
		(0.0533)		(0.6177)		(0.0004)
Catholic		0.1121***		0.2233		-0.0001
		(0.0165)		(1.2787)		(0.0001)
Observations	140	134	82	82	104	100
R-squared	0.08	0.54	0.01	0.14	0.06	0.24
F-test	5.10**	40.97***	1.22	1.44	4.79*	88.48***

deviation increase in surveillance intensity reduces the number of organs donated post mortem per 100,000 inhabitants by 1 across the districts in East Germany. Note that the mean number of organs donated per 100,000 inhabitants is a mere 2, thus suggesting that a one standard deviation increase in Stasi informer density reduces organ donations by up to 50% of the sample mean.

The statistical significance of our reduced form regression estimates (columns 1, 3, and 5) is weakest for our organizational involvement measure. The coefficient for sports club membership has the hypothesized sign but is significant (at p≤0.05) only in the regression with controls. The explanation we have in mind is as follows. Central and defining feature of the GDR was the presence of the communist party as the locus and core of all social organization (Bunce, 1999, p.28). Given the importance attached to top-level sport in the GDR, designated Stasi informers systematically filled all important positions in sports clubs, as they did in most other organizations.[18] Thus, in the former GDR a positive relation between surveillance intensity and membership in sports clubs would be expected. This biases our findings for the post-communist era towards a less negative relationship between surveillance density and sports club membership than there actually is. Our results for the influence of surveillance intensity on current organizational involvement should thus be interpreted as a lower bound for the actual effect.

The results for our alternative explanatory variables are at best mixed. First, the positive coefficient for Urbanization in all regression specifications suggests

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[18]See also the more detailed discussion in Section 5.1.4.

higher electoral turnout, organ donation activity and organizational involvement in more urban areas. Second, sign and statistical significance of control variable Migration indicate that, in line with Glaeser and Redlick (2009), the prospect of out-migration reduces individuals' returns to social capital and thus the local stock of civic spiritedness. According to our evidence, individuals in regions with higher degrees of out-migration (negative values of $Migration$) are less likely to vote, less likely to be members in local sports clubs, and less likely to donate organs post mortem. The positive coefficients for the square of Migration, however, does not support evidence presented by Sampson (1988) that demographic instability may dissolve social solidarity and disrupt existing community ties. The results for $Education$ are twofold. On the one hand, electoral participation seems lower in districts with higher levels of education. On the other hand, individuals in districts with higher education levels are more active in sports organizations and more active organ donors. The latter effects, however, are statistically insignificant. Finally, in accordance with existing evidence in the literature we find a strong and positive relation between religiosity and two of our measures of civic involvement, electoral turnout and organ donations. The coefficients for Protestant and Catholic, however, have negative signs in column 4, which may reflect that active involvement in religious groups and membership in sports clubs are substitutes for time-constrained individuals.

In Panel B we estimate the relationship between surveillance intensity and social capital controlling for regional fixed effects in the form of federal state dummies. This addresses the concern that our relationship between surveillance intensity and social capital is driven by the presence of a confounding factor that differs (or even historically always differed) across regions and is positively correlated with surveillance and negatively related to our dependent variable. Using federal state fixed effects has the advantage that the regression coefficients only capture within-federal-states variation. The results are strong confirming evidence for our results obtained in Panel A.

One related concern about our results in Panel A is that they may be infected by possible measurement errors. As a result of redistricting current districts in East Germany are only imperfect matches with their 1989 counterparts. In Panel C, we therefore weight all observations by the relative similarity between current and historical district size. The results are very similar using this alternative specification strategy. We also rerun the regressions in Panel C based on observations weighted by the difference in current and historical district population and the results are even stronger evidence in favor of our central hypothesis (not reported).

Finally, it may be that our control variables insufficiently well capture the alternative explanations for social capital put forward in the literature. To address this concern we obtain from Destatis alternative measures for our control variables Urbanization and Migration, and rerun all our regressions. We use the fraction of the total district area that is not forest or agricultural area relative to the total district area as an alternative measure of Urbanization. For

Migration we test the robustness of our results using three additional proxies. First, we obtain the percentage of the net migration across district borders relative to the total district population in 2007. Second, on the assumption that a brain drain of young, talented individuals is particularly consequential for local productivity, we use the percentage of the average annual net migration of individuals aged 18 to 29 across district borders in 2000-2005 relative to the district population of 18 to 29 year-olds. Third, we obtain a similar measure for young out-migration for 2007. Finally, we rerun all our regressions including the square of the district population as an additional regressor. The thrust of our results does not change using these alternative measurement and specification strategies.[19]

5.1.4 The exogeneity of surveillance intensity

Any causal relation from surveillance intensity to social capital erosion would be called into question if a) social capital patterns in the East German lands of the 1940s/1950s had a significant influence on the Stasi's choice of scale and depth of penetration of people's private lives across districts (thus causing reverse causality), b) social capital patterns before the surveillance "treatment" are highly correlated with current social capital (thus resulting in spurious effects of surveillance density), or c) high surveillance districts are systematically different from low surveillance intensity districts in another way that is directly or indirectly correlated with social capital.

Table 4 shows that this possibility is rejected. In this table, we analyze the explanatory power of 25 potential covariates of surveillance intensity (Staatliche Zentralverwaltung für Statistik, 1989; Grundmann, 1997), and also investigate the effect of social capital before the communist regime shock on surveillance intensity in the GDR. As our key check that our districts did not already have dissimilar levels of social capital before the surveillance "treatment" we use electoral turnout in the 1946 state elections held in the German territories then occupied by the Soviet Union. The data are available from Broszat and Weber (1993).[20] These elections were the first state elections after the collapse of the Third Reich and are considered the last elections that were still reasonably free and fair (Schmitt, 1993; Hajna, 2000).[21] The dependent variable in Table 4 is the district level surveillance intensity in 1989.

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[19]For brevity the results are not reported but are available from the authors.

[20]We adjust the data for redistricting and exclude East Berlin because West German parties could run their own candidates in East Berlin at that time.

[21]For propaganda purposes, voter turnout data were manipulated in subsequent elections in the GDR to show significantly greater electoral participation than could realistically be achieved. We thus had to choose earlier data that were relatively free of such electoral fraud concerns.

Table 4: Test of Exogeneity of Stasi Surveillance

This table shows estimates of the effect of 25 district characteristics and social capital in 1946 on the concentration of Stasi personnel in the GDR. The dependent variable is *Surveillance*, the fraction of Stasi informers active in the district relative to the district population (in thousand people). Robust standard errors clustered at the regional level are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively. *Constant* is the intercept of the regression equation. *Pop. Density* is the population density, measured by total district population relative to the territorial area in square kilometers. *Foreigners* measures the percentage of foreigners relative to the district population. *Sports facilities* is the number of gymnasia and sports halls per ten thousand people. *Schools* measures the number of GDR standard schools up to 10th grade per ten thousand people. *Classrooms* is the number of classrooms per ten thousand people. *Clubhouses* is the number of culture and cub houses per ten thousand people. *Apartm. blocks* is the number of apartment blocks per capita. *Working age* measures the percentage of population in working age. *Retired* is the percentage of population in retirement age. *Industry empl.* measures industrial employment and is defined as the percentage of the employed population that is employed in the industrial sector. *Agric. empl.* is the percentage of employed population that is employed in the agricultural and forestry sector. *High qualification* is the percentage of working population that has a university degree. *Skilled workers* measures the percentage of the working population that has vocational school education. *Research* is the percentage of the working population employed in research. *Male* is the percentage of the male population relative to the total population. *Age* $18 - 50$ is the percentage of the population aged 18 to 50. *Housing space* measures the living space in sqm per inhabitant. *Modern heating* is the percentage of apartments equipped with modern heating. *Private housing* is the percentage of housing stock that is privately owned. *Medical doctors* measures the ratio of people per medical doctor. *Hospitals* is the number of hospitals per ten thousand people. *Hospital beds* measures the number of hospital beds per capita. *Dust emission* measures dust emission intensity in tons per sqkm. *Sulf. emission* measures sulfure dioxide emission intensity in tons per sqkm. *Nitr. emission* measures nitrogen monoxide emission intensity in tons per sqkm. *Turnout* 1946 is the electoral turnout in the 1946 state elections held in the German territories then occupied by the Soviet Union. *Turnout* 2002 is the electoral turnout in the German federal elections in 2002. *Turnout* 2005 is the electoral turnout in the German federal elections in 2005. *Fed. states* indicates that regional fixed effects in the form of federal state dummies are included. *Observations* is the number of districts for which all information was available. $R - squared$ is the coefficient of determination of the equation.

Covariate	Infrast./ ideology	Economics	Other	Social capital 1946	Social capital 2002	Social capital 2005
Constant	0.5882	-12.7130	-65.8820***	29.8899	32.4707	43.1496
	(3.4882)	(34.4119)	(18.2778)	(65.9764)	(45.4708)	(47.7561)
Pop. density	-0.0012			0.0010	-0.0006	-0.0007
	(0.0007)			(0.0011)	(0.0010)	(0.0010)
Foreigners	0.2767			-0.1040	-0.1934	-0.0467
	(0.2776)			(0.3674)	(0.3248)	(0.3325)
Sports facilities	0.0953			0.0862	0.2664	0.2220
	(0.4070)			(0.1944)	(0.1957)	(0.1969)
Schools	-0.4757			-0.9372	-0.5787	-0.7255
	(0.4942)			(0.7018)	(0.4827)	(0.4343)
Classrooms	0.1402			0.1137*	0.0185	0.0333
	(0.0911)			(0.0542)	(0.0375)	(0.0358)
Clubhouses	0.6488			0.5294	-0.0358	0.0738
	(0.6115)			(0.5865)	(0.6656)	(0.6368)
Apartm. blocks	-9.9371			49.4790**	58.3335**	56.7521**
	(18.5794)			(18.2239)	(20.5007)	(19.8865)
Working age		0.4069		-0.9960	-0.5727	-0.6431*
		(0.3844)		(0.5898)	(0.3188)	(0.3254)
Retired		-0.2640		-0.3060	-0.0595	-0.0742
		(0.3621)		(0.3342)	(0.1556)	(0.1706)
Industry empl.		0.0279		0.0388*	0.0148	0.0187
		(0.0507)		(0.0176)	(0.0175)	(0.0190)
Agric. empl.		0.0631*		-0.0443	0.0040	0.0055
		(0.0304)		(0.0556)	(0.0365)	(0.0458)
High qualification		0.0077		-0.6853	-0.4422	-0.4786
		(0.3807)		(0.4026)	(0.5092)	(0.4508)
Skilled workers		-0.0621		-0.0968	-0.0548	-0.0853
		(0.1537)		(0.1437)	(0.1880)	(0.1758)
Research		-0.2968		0.0797	-0.0335	-0.0003
		(0.3785)		(0.3428)	(0.2436)	(0.2192)
Male			1.3163**	1.1284	0.6135	0.6896
			(0.5058)	(0.7509)	(0.5566)	(0.5518)
Age 18-50			-0.1556	-0.3472	-0.0224	-0.0606
			(0.2241)	(0.2278)	(0.2131)	(0.2017)
Housing space			0.5807**	0.3211	0.3963	0.3863
			(0.2395)	(0.2550)	(0.2469)	(0.2237)
Modern heating			0.0303	0.0853*	0.1004***	0.1155***
			(0.0492)	(0.0424)	(0.0239)	(0.0230)
Private housing			0.0164	-0.1326*	-0.1240*	-0.1121*
			(0.0311)	(0.0634)	(0.0583)	(0.0539)
Medical doctors			0.0000	-0.0028	-0.0065***	-0.0065***
			(0.0018)	(0.0027)	(0.0017)	(0.0017)

Covariate	Infrast./ ideology	Economics	Other	Social capital 1946	Social capital 2002	Social capital 2005
Hospitals			-0.2124	-1.5540	-1.8422	-1.7249
			(1.3210)	(1.8670)	(1.1756)	(1.1034)
Hospital beds			-0.0078*	-0.0136*	-0.0088**	-0.0107**
			(0.0039)	(0.0061)	(0.0034)	(0.0033)
Dust emission			0.0107***	0.0277**	0.0329**	0.0314**
			(0.0026)	(0.0091)	(0.0115)	(0.0110)
Sulf. emission			-0.0101***	-0.0032	0.0018	0.0020
			(0.0027)	(0.0080)	(0.0017)	(0.0016)
Nitr. emission			0.2032**	-0.1714	-0.1664*	-0.1699*
			(0.0626)	(0.1663)	(0.0827)	(0.0834)
Turnout 1946				-0.0026		
				(0.0956)		
Turnout 2002					-0.3717**	
					(0.1163)	
Turnout 2005						-0.4643***
						(0.1094)
Fed. states	Yes	Yes	Yes	Yes	Yes	Yes
Observations	111	121	109	65	92	92
R-squared	0.24	0.22	0.50	0.69	0.59	0.59

Regression estimates show that with a few exceptions the potential covariates for surveillance intensity have little explanatory power. In fact, surveillance intensity seems most associated with district characteristics in the 'Other' category. When we include all 25 characteristics only the number of apartment blocks per capita, the number of classrooms per thousand people, the percentage of apartments with modern heating, the percentage of the housing stock that is privately owned, the number of hospital beds per capita, and the dust emission intensity are statistically significantly associated with surveillance intensity. The nature of these district characteristics, however, is such that they are improbably related to social capital directly or indirectly. This precludes the possibility that systematic differences between high and low surveillance intensity districts that are directly or indirectly correlated with social capital drive our results. Rather, the positive coefficients on *Sports facilities*, *Classrooms*, *Clubhouses*, *Dust emission*, and *Apartm. blocks*, in particular, suggest that in line with anecdotal evidence it was primarily ideological motivations, infrastructural considerations, population, and also a district's political importance that determined the size, structure and personnel intensity of the surveillance apparatus in a district. Primary task of the MfS was to locate and arrest all forms of domestic opposition or political-ideological subversion, and to routinely indoctrinate people in orthodox communism. This was to be carried out in all areas of the society. The MfS thus systematically installed designated Stasi informers in every, for example, school, university, sports organization, political party, apartment block, church and religious group, youth organization, Workers' and Farmers' Inspection (*Arbeiter- und Bauerninspektion*), and clubhouse and cultural facility (Ammer and Memmler, 1991; Provisional People's Chamber, 1950; Giesecke, 2006, p.213). This also implies that Stasi surveillance was higher where people gathered, pursued group activities and exchanged socially and economically. Thus, anecdotal evidence and estimates in Table 4 suggests that at best a positive relationship between surveillance intensity, on the one

hand, and social capital and economics, on the other hand, would be expected.

More importantly, after controlling for potential covariates of surveillance the coefficient for social capital in 1946 is indistinguishable from zero (column 4). This is not to suggest that contrary to evidence in the literature there is no long-term persistence in social capital in East Germany. However, we detect only a weakly positive correlation between current and historical turnout (ρ=0.12 for the 2002 election, and ρ=0.18 for 2005), and a weakly negative relation between historical social capital and surveillance intensity. This suggests that while there may have existed mildly similar social capital patterns at around the time when the GDR was founded as there are today, those were at best weakly related to the intensity of Stasi presence in a district later chosen. In fact, when instead of state election results we use municipality election results from 1946, for which we find a higher number of observations in Broszat and Weber (1993), then the correlation coefficients between current and historical turnout even become negative (ρ=-0.18 for the 2002 election, and ρ=-0.09 for 2005). To show that near-orthogonality of social capital and surveillance intensity is indeed specific to social capital before the 40-year communist regime shock we also show regression results for inclusion of current electoral turnout (columns 5 and 6).[22] In contrast to social capital in 1946, electoral participation in both 2002 and 2005 is highly statistically significant and negatively associated with surveillance intensity. These results show that a) surveillance intensity is unlikely the results of distinct social capital patterns at around the time the MfS established its surveillance apparatus, and b) surveillance is unlikely a spurious effect that merely captures the high correlation between current and historical social capital patterns in the East German regions. Thus we are sufficiently confident about the exogeneity of our surveillance "treatment".

5.1.5   Concerns about omitted districts

A related concern is that inclusion of only those districts for which we could obtain data for all seven informer categories may have resulted in a reduction of the total number of districts to a subset that is biased towards finding a stronger relation between surveillance density and social capital than there actually is. That is, the fact that the Stasi files containing surveillance information for these particular districts were partly or fully destroyed may reflect unobserved characteristics of districts that are in some sense special. For example, the omitted districts may have been home to a particularly well-organized, professional local surveillance unit that, in line with the highest standards of conspiracy, was quick enough to wipe out the regime's traces before they could be discovered after the regime's collapse. The nature of our omitted districts, however, suggests that this is not the case. In fact, in the majority of cases district data for whole regions is missing, but rarely for individual districts in otherwise well covered regions. For example, for regions Potsdam and Dres-

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[22]These regression specifications are for illustrative purposes only. As shown earlier, causality must run from surveillance to electoral turnout.

den we are missing information on social informers for security for all districts. Thus for these two regions our surveillance intensity measure could not be computed. Therefore, in Panel A of Table 5 we repeat our analysis using a measure of surveillance density that contains only the first four categories of informers (see Table 1), for which data coverage is much better allowing inclusion of all observations from regions Potsdam and Dresden. The results using this reduced form measure of Stasi penetration are slightly weaker but very similar to those presented in Table 3. Statistical significance is weakest for regressions with dependent variable sports club membership (columns 3 and 4), where as a result of limited data availability for organizational membership a less precise surveillance measure is applied to an unchanged number of observations.

We were furthermore unable to obtain any surveillance data for districts in the region Cottbus, for 10 of the 15 districts in the region Erfurt, and for 7 of the 11 districts in the region Schwerin. Consequently, we had to make sure that the omitted districts do not exhibit a combination of high surveillance and high social capital (or low surveillance and low social capital) that, if included, would weaken the negative relationship between Stasi penetration and social capital detected in Table 3. We use the aggregate regional level statistics for surveillance intensity which contain the figures for our omitted districts to make this assessment. Cottbus and Schwerin are among the regions with the highest overall surveillance intensity per capita. In line with our hypothesis, we find that for two of our three measures Cottbus and Schwerin also have much lower than average social capital. Furthermore, Cottbus is the district with the second highest unemployment rate, and among the regions with the lowest per capita income and wage and income tax paid. Similarly, Schwerin exhibits an above average unemployment rate. By contrast, Erfurt is one of the regions with the least dense Stasi presence, and ranks among the regions with highest social capital and economic performance across all our measures. Overall, this suggests that inclusion of the omitted districts would have only strengthened our findings in this section and the next. Our results should thus be considered lower bounds of the actual effect of surveillance.

As an additional check we create imputes to substitute for missing data items. We rely on Rubin's (1987) multiple imputation procedure and make use of all dependent and independent variables from Table 3, and all potential covariates of surveillance intensity from Table 4 to impute missing data items. We create 10 imputed data sets. Panel B of Table 5 reports OLS estimates obtained using the imputed data set that delivered the overall weakest p-values for the surveillance intensity regressor. Our results for electoral turnout and organizational membership are robust to this additional robustness check. The substantial increase in the number of observations for sports club membership considerably increases the statistical significance of the negative relation between Stasi penetration and this measure of social capital. Coefficient estimates in columns 5 and 6 are statistically less significant than those presented earlier. This is probably because it is more difficult to impute organ donation

Table 5: Digging Deeper into Omitted Districts

This table shows estimates of the effect of Stasi surveillance intensity in the districts of the former GDR on current levels of social capital in East Germany. Panel A reports OLS estimates using $Surveill.$ $(red.)$, a reduced form measure of surveillance intensity that contains only the first four informer categories from Table 1. Panel B reports OLS estimates imputing for missing data ten times. Multiple imputation is performed using all dependent and independent variables in from Table 3 and all potential covariates of surveillance intensity from Table 4. OLS estimates based on the imputed data set that delivered the weakest results for surveillance intensity are reported. The dependent variable in columns 1-2 is the percentage electoral turnout in the German federal election. In columns 3-4, the dependent variable is sports club membership relative to the district population (in thousand people). The dependent variable in columns 5-6 is the fraction of the number of organs donated in the district relative to the district population (in thousand people). Robust standard errors clustered by region are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively. $Constant$ is the intercept of the regression equation. $Surveill.$ IMP is the fraction of Stasi informers active in the district relative to the district population (in thousand people). It contains the values of $Surveillance$ but missing values are imputed using Rubin's (1987) multiple imputation procedure. $Population$ is the district population (in thousand people). $Area$ is defined as the size of the district in hundred square kilometers. $Urbanization$ is the population density, measured by total district population relative to the territorial area in square kilometers. $Migration$ is defined as the percentage of the average annual net migration across district borders relative to the total district population. $Migration^2$ is defined as the square of $Migration$. $Education$ is the percentage of the district population aged 18 to 29 that graduated from school with a degree that qualifies for tertiary education. $Protestant$ is the percentage of the population that is Protestant. $Catholic$ measures the percentage of the population that is Roman Catholic. $Observations$ is the number of districts for which all information was available. $R - squared$ is the coefficient of determination of the equation. $F - test$ is the F statistic and indicates the significance of the equation.

Panel A: Adjusted surveillance intensity

	Electoral turnout		Sports club membership		Organ donations	
Constant	74.5283***	72.2059***	162.9828***	191.6910***	0.0352***	0.0055
	(1.4324)	(2.0342)	(13.7327)	(42.1514)	(0.0069)	(0.0207)
Surveill. (red.)	-0.6377**	-0.3187*	-3.0036	-7.1048	-0.0041**	-0.0039
	(0.2533)	(0.1735)	(3.4145)	(5.1797)	(0.0018)	(0.0023)
Population		-0.0036		-0.1810		-0.0001
		(0.0042)		(0.1315)		(0.0001)
Area		0.0548		-0.8910		0.0030
		(0.1345)		(2.6638)		(0.0017)
Urbanization		0.0011*		0.0085		0.0000***
		(0.0005)		(0.0123)		(0.0000)
Migration		2.0954***		5.8300		0.0050
		(0.2395)		(21.5157)		(0.0061)
Migration^2		0.6844		6.4055		0.0084*
		(0.4056)		(11.8373)		(0.0042)
Education		-0.8122*		5.0268		0.0027
		(0.3894)		(5.6258)		(0.0030)
Protestant		0.1621***		-1.1750*		0.0005
		(0.0399)		(0.6519)		(0.0004)
Catholic		0.0973***		-0.2582		-0.0001
		(0.0216)		(1.3305)		(0.0002)
Observations	178	168	82	82	141	133
R-squared	0.08	0.56	0.01	0.13	0.02	0.13
F-test	6.34**	17.17***	0.77	1.12	5.34**	12.18***

Panel B: Multiple imputation of missing data

	Electoral turnout		Sports club membership		Organ donations	
Constant	73.5891***	70.1505***	172.4291***	197.1435***	0.0282***	0.0246
	(1.1175)	(1.8077)	(8.2668)	(20.3907)	(0.0088)	(0.0176)
Surveill. IMP	-0.2236	-0.1545*	-3.5265***	-3.8633***	-0.0011	-0.0002
	(0.1594)	(0.0758)	(1.2217)	(1.4218)	(0.0017)	(0.0018)
Population		0.0007		-0.0764		0.0000
		(0.0019)		(0.0519)		(0.0000)
Area		0.0791		0.0740		0.0010
		(0.0642)		(1.0255)		(0.0008)
Urbanization		0.0006***		0.0055*		0.0000
		(0.0002)		(0.0029)		(0.0000)
Migration		2.1816***		-8.1485*		0.0007
		(0.2630)		(4.4712)		(0.0049)
Migration^2		1.1068***		-1.2396		0.0017
		(0.2597)		(3.2828)		(0.0032)
Education		-0.4862		0.4749		-0.0021
		(0.3691)		(3.7949)		(0.0030)
Protestant		0.1977***		-1.3931***		-0.0001
		(0.0394)		(0.4153)		(0.0004)
Catholic		0.1220***		0.3040		0.0000

Table 5: *Continued*

	Electoral turnout		Sports club membership		Organ donations	
		(0.0106)		(0.2239)		(0.0002)
Observations	224	224	222	222	184	186
R-squared	0.03	0.57	0.03	0.13	0.00	0.05
F-test	1.97	56.03***	8.33***	4.28***	0.38	1.05

activity that is characterized by a high share of zero values, a very low mean, and high standard deviation.

In sum, the preceding analyses established that differences in Stasi surveillance intensity across the districts in the former GDR have significant explanatory power for the social capital patterns observed in these regions today. This confirms earlier evidence presented by Howard (2003) on the weakness of post-communist civil societies that inheres in the climate of mistrust and anxiety created under these oppressive regimes. To test our second key conjecture that Stasi surveillance and the resulting social capital erosion in the GDR may help explain the persistent differences in economic prosperity between East and West Germany we analyze next the relation between social capital and economic performance in the districts in East Germany.

5.2 Social capital and economic performance

The causal relation between social capital and economic performance is inherently difficult to establish, for it can be argued for causality running both ways. However, an impressive body of scholarly research suggests that where trust and cooperation thrive, individuals, firms, communities and nations prosper (Knack and Keefer, 1997; La Porta, Lopez-de Silanes, Shleifer, and Vishny, 1997; Guiso, Sapienza, and Zingales, 2004; Guiso, Sapienza, and Zingales, 2006). We use instrumental variable 2SLS regressions to preclude reverse causality and estimate the effect from social capital to economics. To qualify as instruments for the potentially endogenous regressor social capital, our instrumental variables in the first stage of the IV 2SLS regressions had to fulfill two criteria. The first important characteristic our instruments had to fulfill was high correlation with social capital. Section 5.1 showed that surveillance intensity was far from uniform across the East German lands and that it has significant explanatory power for current social capital. Surveillance intensity thus provides us with the necessary identifying variation to instrument for social capital. Our analysis further yields that because border protection was one of the main tasks of the MfS necessitating a denser surveillance apparatus in border districts, two geographical accidents can furthermore be usefully employed as instruments for social capital. Those are a) *Border*, a dummy that takes the value of one if the district in the former GDR had a border with another country, and zero otherwise, and b) *Border* (*sea*), a dummy that takes the value of one if the district in the former GDR had a sea border, and zero otherwise.

The other important characteristic of useful instruments is lack of correlation with the disturbance ϵ in the second stage regressions. That is, our

instruments must have "accidental" characteristics that make them orthogonal to economic performance. For surveillance intensity to fulfill the characteristics of a historical accident that can serve as a powerful instrument for social capital we must ask whether Stasi surveillance was somehow more intensively targeted towards regions in East Germany that were more likely to have lower economic performance. This does not seem to be the case for at least two reasons. First, Stasi IMs did not receive a regular salary from the Ministry of State Security – instead they were unpaid, unofficial informers who only received seeming privileges and occasional pecuniary perks for assignments completed successfully (Ammer and Memmler, 1991; Bürgerkomitee Leipzig, 1991). Analysis of the Stasi records yields that political and ideological conviction, coercion and fear, personal advantage, emotional needs, and a desire to influence official policy were the main motives for collaboration (Dennis, 2003). This discards the possibility that in districts where economic prosperity was lower, more people had economic incentives to work for the Ministry of State Security as an additional source of income.[23] It also precludes that income per capita differed systematically across districts depending on the fraction of the population that received income from the MfS for surveillance activities. Second, more generally, as we have shown in more detail in Section 5.1.4, anecdotal and empirical evidence strongly suggests that not patterns of economic performance but ideological motivations, infrastructural considerations, and a district's political importance determined the size, structure and personnel intensity of the surveillance apparatus across regions. This makes us confident that we can take surveillance to be exogenous.

There is a related concern about our border dummies. Standard economic theory would suggest that border regions benefit from trade activity across borders more than other districts, thus exhibiting better economic performance. Yet, the borders of the GDR are the result of zones of occupation demarcated by the Allies after World War II. Before World War II, the districts that later in the GDR became border districts were located in the heartland of the German territories. More so, the new GDR borders under Soviet occupation were often located such that they did not follow existing district demarcations. Hence, border districts in the GDR became border districts as the result of a historical accident par excellence. Correlation coefficients between our border dummies and the economic measures employed in this study confirm a near orthogonal relationship.[24]

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[23]More importantly, it was not possible to offer one's services to the MfS, which further discards concerns over self-selection into collaboration with the Stasi. Instead, designated Stasi personnel responsible for IM recruitment selected and approached potential new informants. Before the MfS made formal contact to a prospective IM, it carefully unvovered the potential recruit's personal background and history, her relationships and usefulness for future assignments, her ideological conformity, and any problems (debts, discontentment, etc.) which might facilitate recruitment (Gill and Schröter, 1991; Dennis, 2003).

[24]We do not use a dummy for districts which had a border with West Germany because our pre-analysis showed that those exhibit a sufficiently high positive relationship with current economic outcomes.

5.2.1 Dependent variables

Having established a number of instruments for social capital with unique accidental features we can estimate the relationship between social capital and economic performance that is free of reverse causality concerns. We obtain two indicators of economic performance at the district level from Destatis. In Panel A of Table 6 the dependent variable is the fraction of the total per capita income in the district (in thousand €) in 2004.[25] The dependent variable in Panel B is the district level average unemployment rate in 2007.

5.2.2 Explanatory variables

Our central explanatory variable in the second stage regressions in Table 6 is the level of social capital. We use the three social capital indicators established in the preceding analyses (Table 3), namely electoral turnout (column 2), sports club membership (column 4), and organ donation activity (column 6).

To be sure, while we posit a significant positive relation between social capital and economic performance, any single-factor interpretation that suggests that social capital is the only – or even most important – determinant of differences in economic performance across the regions in East Germany is surely wrong. Consequently, we control for and discuss a set of possible alternative explanations for differences in regional economic performance, namely a) urbanization, b) human capital out-migration and personnel stability, c) education, and d) productivity. We will consider each in turn.

One central argument presented in the literature (see, for example Putnam, 1993; Acemoglu, Cantoni, Johnson, and Robinson, 2010) is that in the modern world urbanization in highly correlated with economic performance. As a result, we control for urbanization at the district level using our control *Urbanization* that measures the population density in a district.

Another argument for economic disparity across the regions in East Germany is that of varying levels of human capital out-migration and personnel stability. After all, human capital out-migration may deprive districts of key talent which, in turn, impinges on average education and skills levels, and, ultimately, economic performance. Since German re-unification hundreds of thousands out-migrated from East Germany for better job opportunities and pay in the West. Despite the swell in high-tech, high-paying jobs, emigration from East Germany has even accelerated in recent years, with one percent of the 18-29 year-olds emigrating each year (Uhlig, 2008). That said, some scholars have furthermore suggested that East Germany's future may well be one in which a few metropolitan areas such as Berlin, Dresden, Frankfurt (Oder), Leipzig, and Halle reach parity with the West, while vast rural stretches continue to depopulate. It may thus be that those districts which have experienced particularly severe brain-drains exhibit worse economic performance. Consequently, we control for human capital out-migration using *Migration*, the percentage

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[25]Income data for 2004 are the latest available at the district level. Destatis publishes theses data triennially. 2007 figures will be available from 2011.

of the average annual net migration across district borders. To control for differences in personnel stability across the districts in our sample we include the square of Migration, $Migration^2$.

A related argument is that district level economic performance may be positively related to local education levels and labor productivity. Naturally, where people are more qualified and thus more productive, economic performance should flourish. As a result, we use *Education* and *Productivity* to control for qualification and production differentials across districts. Education is the percentage of the district population aged 18 to 29 that graduated from school in 2007 with a degree that qualifies for tertiary education. District level statistics on productivity are difficult to obtain, and we have to rely on best possible approximations. We opt for labor productivity which we measure as the ratio of produced goods and services relative to labor input (in thousand man-hours) in the manufacturing industry. The latest available information on labor productivity is from Destatis and for 2002.

Finally, as in the first stage we include district level population (*Population*) and size of the district (*Area*) controls.

5.2.3 Results

The results in Table 6 are strong confirming evidence of a significant positive relation between social capital and economic performance in East Germany. The positive relation is consistent across alternative measures of social capital and economic performance. In Panel A, the coefficient for *Social capital* is significant (at $p \leq 0.10$ in column 2 and 4) and has the hypothesized positive sign, which is suggestive that social capital has a positive impact on income per capita in East Germany. In Panel B, the coefficient estimates are in line with our hypothesis and show a significant (at $p \leq 0.05$ in column 2, and at $p \leq 0.10$ in column 4) and negative relation between electoral turnout and unemployment. Naturally, in column 6 of Panel B where the power of the excluded instruments is lowest, we find the only instance in Table 6 where the coefficient for organ donations is insignificant in the second stage regression.

Columns 1, 3, and 5 in Table 6 report the first stage estimates of our IV regressions. Hansen J statistics confirm orthogonality of our instruments to the error process in the second stage regressions. As the F-test of excluded instruments shows, statistical significance of our social capital measures is higher in the second stage where surveillance intensity and our border dummies are better instruments for social capital in the first stage regressions in Table 6.

Overall, our results strongly suggest that we have identified a key determinant of economic disparities among the regions in East Germany. Regression coefficients indicate that a one standard deviation increase in social capital – equivalent to a 2.92 percentage point increase in voter turnout, or 55 additional members in sports clubs per thousand people, or an increase of 4 organ donations per 100,000 people – is associated with a €204 to €759 increase in income per capita, or about 2.4% to 9.0% of the sample mean. Similarly, a one

Table 6: Social Capital and Economic Performance

This table reports IV (2SLS) regression estimates of the effect of social capital on current economic performance across the districts in East Germany. The dependent variable in Panel A is the total per capita income in the district (in thousand €). In Panel B, the dependent variable is the district's average unemployment rate. Columns 1, 3, and 5 present the first stage IV regression estimates. Columns 2, 4, and 6 show the estimates from the second stage of the IV regressions. Regressions are weighted using the relative similarity between current and historical district size. Robust standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively. *Constant* is the intercept of the regression equation. In columns 1-2, *Social capital* is the percentage electoral turnout in the German federal election. In columns 3-4, *Social capital* is defined as the membership in sports clubs relative to the district population (in thousand people). *Social capital* in columns 5-6 is measured by the fraction of the number of organs donated in the district relative to the district population (in thousand people). *Population* is the district population (in thousand people). *Area* is defined as the size of the district in hundred square kilometers. *Urbanization* is the population density, measured by total district population relative to the territorial area in square kilometers. *Migration* is defined as the percentage of the average annual net migration across district borders relative to the total district population. $Migration^2$ is the square of *Migration*. *Education* is the percentage of the district population aged 18 to 29 that graduated from school with a degree that qualifies for tertiary education. *Productivity* is the district-level labor productivity, measured by the ratio of produced goods and services to labor input (in thousand man-hours) in the manufacturing industry. Surveillance is fraction of Stasi informers active in the district relative to the district population (in thousand people). *Border* is a dummy that takes the value of one if the district in the GDR had a border with another country, and zero otherwise. *Border (sea)* is a dummy that takes the value of one if the district in the GDR had a sea border, and zero otherwise. *Observations* is the number of districts for which all information was available. $F-test$ refers to the test of excluded instruments. First stage F statistics are heteroskedasticity-robust. $HansenJ-test$ is the Hansen J statistic for the overidentification test of all instruments.

Panel A: Income per capita

	Electoral turnout		Sports club membership		Organ donations	
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
Constant	77.3999***	2.6265	150.5047***	6.0532***	0.0274	7.5140***
	(0.8728)	(3.0441)	(45.0053)	(1.0291)	(0.0175)	(0.3532)
Social capital		0.0698*		0.0138*		13.5193
		(0.0409)		(0.0074)		(9.4334)
Population	-0.0233***	-0.0006	-0.4024**	0.0037	0.0001	-0.0041
	(0.0082)	(0.0018)	(0.1788)	(0.0031)	(0.0002)	(0.0034)
Area	0.0915	0.0157	1.5574	0.0154	0.0011	0.0042
	(0.0740)	(0.0177)	(2.1964)	(0.0267)	(0.0011)	(0.0236)
Urbanization	0.0022***	0.0005**	0.0246*	0.0002	0.0000	0.0005
	(0.0005)	(0.0002)	(0.0138)	(0.0003)	(0.0000)	(0.0004)
Migration	1.0934***	0.2789	10.4479	0.8361***	0.0117	0.4240
	(0.4009)	(0.2243)	(20.9892)	(0.2736)	(0.0101)	(0.3727)
$Migration^2$	-0.6748	-0.0205	7.1620	0.2789	0.0109*	-0.1127
	(0.5362)	(0.1774)	(12.7957)	(0.2016)	(0.0062)	(0.2473)
Education	-0.7739***	0.2929***	11.5022	0.0252	-0.0025	0.3735***
	(0.2727)	(0.0964)	(12.2302)	(0.2172)	(0.0055)	(0.1240)
Productivity	0.0186**	0.0008	0.1845	0.0058	0.0001	0.0019
	(0.0079)	(0.0042)	(0.3874)	(0.0052)	(0.0002)	(0.0046)
Surveillance	-0.4042***		-7.2715		-0.0044*	
	(0.1039)		(4.5966)		(0.0024)	
Border	1.0361**		19.2100		0.0226**	
	(0.4434)		(15.1005)		(0.0099)	
Border (sea)	-5.5922***		7.9512		-0.0213*	
	(0.9038)		(21.5490)		(0.0108)	
Observations	86	86	46	46	61	61
F-test	27.43***		2.45*		2.93**	
Hansen J-test		1.64		2.03		1.09
P-value Hansen J		(0.4410)		(0.3628)		(0.5804)

Panel B: Unemployment rate

	Electoral turnout		Sports club membership		Organ donations	
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
Constant	76.1670***	60.0179***	163.3691***	33.4701***	0.0208	25.8611***
	(0.9402)	(18.1671)	(56.0149)	(6.3398)	(0.0186)	(2.4646)
Social capital		-0.4923**		-0.0643*		-82.8919
		(0.2509)		(0.0372)		(92.5872)
Population	-0.0162	-0.0028	-0.1663	-0.0164	0.0001	0.0118
	(0.0115)	(0.0102)	(0.2315)	(0.0205)	(0.0002)	(0.0289)
Area	0.0604	-0.7773***	-3.4168	-0.9948**	-0.0011	-0.9895**
	(0.2292)	(0.2707)	(2.7279)	(0.4469)	(0.0022)	(0.4437)
Urbanization	0.0020***	-0.0022**	0.0147	-0.0009	0.0000	-0.0019
	(0.0007)	(0.0010)	(0.0161)	(0.0015)	(0.0000)	(0.0019)
Migration	1.2979***	-0.4352	15.5631	-3.6548***	0.0111	-1.5213
	(0.3924)	(1.2157)	(22.5935)	(1.3632)	(0.0111)	(2.0462)

	Electoral turnout		Sports club membership		Organ donations	
Migration[2]	-0.3484	0.9765	12.8870	-0.1867	0.0120*	1.3421
	(0.4891)	(1.0442)	(14.1903)	(1.2260)	(0.0066)	(1.8378)
Education	-0.8238***	-1.0605*	4.7281	-0.5244	-0.0002	-1.0494
	(0.2634)	(0.5764)	(17.9552)	(1.6027)	(0.0054)	(0.8587)
Productivity	0.0205**	0.0417**	0.1675	0.0101	0.0000	0.0184
	(0.0088)	(0.0205)	(0.3697)	(0.0270)	(0.0002)	(0.0249)
Surveillance	-0.2992***		-7.9982		-0.0034	
	(0.1032)		(5.4310)		(0.0024)	
Border	0.8863**		30.9485		0.0177	
	(0.4352)		(22.0275)		(0.0137)	
Border (sea)	-5.0485***		11.4327		-0.0124	
	(0.9182)		(29.2149)		(0.0159)	
Observations	69	69	36	36	50	50
F-test	18.93***		3.57**		1.25	
Hansen J-test		0.88		3.39		0.84
P-value Hansen J		(0.6454)		(0.1839)		(0.6558)

standard deviation increase in social capital reduces unemployment by 1.4 to 3.5 percentage points, which is about 6.4% to 15.9% of the sample mean. Since West Germany during the same historical period did not suffer from a state security body that invaded every aspect of people's lives and all spheres of state and society, our results suggest that surveillance intensity and the ensuing social capital erosion in East Germany may be an important explanatory factor for the persistent differences in economic prosperity between East and West Germany. In fact, when we set the surveillance density to zero for West Germany and to the mean value of 6.12 observed across the districts in our sample for East Germany, then following the regression estimates in Tables 3 and 6 surveillance in the former GDR explains 0.7 to 2.3 percentage points of the difference in the unemployment rate between East and West Germany. Using the figures set out at the beginning of this paper, this is a sizable effect and accounts for approximately 10.9% to 36.3% of the unemployment differential between East and West Germany. The mean difference in unemployment rate explained across our social capital measures is 1.6 percentage points, or 25.6% or the unemployment disparity. Similarly, following our regression results the difference in surveillance between East and West explains € 97 to € 491 of the € 4,500 difference in income per capita. This corresponds to between 2.2% and 10.9% of the overall gap, with a mean difference explained of 6.6% (€ 298).

Our results complement the impressive range of economic phenomena scholars have successfully explained using social capital: economic growth (Knack and Keefer, 1997), financial development (Guiso, Sapienza, and Zingales, 2004, 2006), size of firms (La Porta, Lopez-de Silanes, Shleifer, and Vishny, 1997), and innovation (Fountain, 1997). We also find supportive evidence for most of our control variables. First, for all of our three social capital variables the coefficients for Urbanization have the 'correct' positive (Panels A) and negative (Panel B) signs, respectively, indicating that urbanization is positively related to economic performance. The coefficients are statistically significant in column 2 across both panels.

Second, consistently across all regression specifications Migration has the expected positive sign in Panel A, and the expected negative sign in Panel B.

This suggests that in line with earlier evidence presented in the literature, out-migration is negatively related to economic prosperity in a district. Similarly, the square of Migration has the expected negative sign in columns 2 and 6 of Panel A, and the correct positive sign in columns 2 and 6 in Panel B. This confirms our conjecture that low labor turnover (high residential stability) is associated with local skill formation and higher economic performance. The coefficients for Migration^2 in column 4, however, are not statistically significant and have contradictory signs.

Finally, both Education and Productivity carry the correct positive sign in Panel A, and Education has the expected negative sign in Panel B, thus supporting the notion in the literature that local skill levels and labor productivity are powerful correlates of economic performance. The coefficients for Education are highly statistically significant or have p-values at borderline levels of significance in two of the three second stage regression specifications.

6 CONCLUSION

In this paper we present rare empirical evidence of social capital destruction through state action. Putting forward a formal model and investigating empirical evidence from the districts of the former GDR, we find that people's experience of living in a regime in which state security informers had their tentacles in every aspect of people's lives has resulted in a strong and lingering sense of mistrust of members of society outside the immediate family circle. The erosion of trust and cooperativeness in the former GDR is manifest in lower current levels of social capital in post-communist East Germany. We furthermore find robust evidence that surveillance intensity has a strong negative effect via social capital on current economic performance in these regions. Since West Germany did not experience an oppressive regime shock and intense secret police surveillance during the same historical period, our results suggest that Stasi surveillance and the ensuing social capital erosion in East Germany may be important explanatory factors for the persistent differences in economic prosperity between East and West Germany.

The results presented in this paper invite scholarly research on other post-communist economies with substantial secret police activities to confirm the relationship between surveillance intensity, social capital and economic performance detected in this paper. Also, the coming to terms with the secret police past considerably differs across the transition economies in Eastern Europe. In Germany the management of the Stasi archives was soon after the collapse of the communist regime put under the authority of a Special Commissioner, and personal Stasi files were made accessible to the public. This has in many cases led to the rigorous unmasking of former Stasi informers. By contrast, Russia archives, for example, have proved far less accessible to scholars and the public than the files of the former GDR agency. In fact, even today access to the highly sensitive KGB files is is limited at best (Dennis, 2003). This encourages comparativist scholarship that investigates how these different processing

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strategies facilitate or hinder social capital building and economic recovery in post-communist societies.

Finally, at a more general level, our paper makes a strong case for democratic institutions, and strongly suggests that investments in social capital are worthwhile because a vibrant civil society can foster better economic performance. This has relevance for all economies around the world, and for post-communist countries and those that have experienced other forms of oppressive regimes, in particular. Autocratic and hierarchical regimes that perpetuate thanks to a repressive State Security apparatus, imposition or brutal force as opposed to consensus are natural vehicles of creation of a culture of mistrust. By contrast, democracy equips individuals with self determination and individual autonomy. This encourages individual initiative and willingness to collaborate and join forces with others outside the narrow family and friends circle. The persistent differences in social capital and economic prosperity between East and West Germany are a telling case for policy-makers: the formal model put forward in this paper indicates that, absent positive external shocks, it could probably require another several generations until the scope of cooperation in East Germany converges on the level characteristic of West Germany.

A APPENDIX

A.1 Summary statistics

	N	Min	Max	Mean	Median	StDev.
Surveillance density	147	0.23	21.53	6.12	5.88	2.73
Electoral turnout	209	64.30	78.10	73.82	72.80	2.92
Sports club membership	129	50.01	596.27	154.16	148.05	55.05
Organ donations	169	0.00	0.27	0.02	0.00	0.04
Income per capita	199	6.13	11.77	8.43	8.38	0.85
Unemployment rate	185	11.57	34.38	22.04	21.75	4.95
Population	210	2.59	510.51	53.49	21.42	83.53
Area	205	0.11	25.75	1.37	0.77	2.38
Urbanization	205	5.31	95.74	19.49	15.35	14.35
Migration	199	-2.83	1.29	-0.50	-0.60	0.63
Migration^2	199	0.00	8.02	0.65	0.42	0.81
Education	199	1.33	5.93	2.86	2.53	0.88
Protestant	199	7.37	42.12	19.66	18.31	7.59
Catholic	199	1.44	71.57	3.99	2.80	7.13
Productivity	142	13.32	110.84	48.25	43.17	17.67
Border	227	0.00	1.00	0.35	0.00	0.48
Border (sea)	227	0.00	1.00	0.06	0.00	0.24

A.2 Prior updating

Suppose the individual invests in the first period and therefore can learn and update his priors in the second. Using Bayes' theorem, we have

$$\pi((1-p_1)|R) = \frac{\pi(R|(1-p_1))\widehat{\pi}}{\pi(R|(1-p_1))\widehat{\pi} + \pi(R|(1-p_2))(1-\widehat{\pi})} = \frac{(1-p_1)^{n_i}\widehat{\pi}}{(1-p_1)^{n_i}\widehat{\pi} + (1-p_2)^{n_i}(1-\widehat{\pi})} \quad (5)$$

and

$$\pi((1-p_1)|\neg R) = \frac{(1-(1-p_1)^{n_i})\widehat{\pi}}{(1-(1-p_1)^{n_i})\widehat{\pi} + (1-(1-p_2)^{n_i})(1-\widehat{\pi})} \quad (6)$$

as the updated probabilities of drawing from the distribution of types in the "trustworthy" environment conditional on observing R or $\neg R$, respectively.

A.3 Proof of Lemma 1

Following equations 1 and 2 we seek to find such n (size of the reciprocity game) as to maximize an individual's return denoted by the function

$$P_i(p_i, n_i, \delta) = n_i^{\delta} \times (1-p_1)^{n_i} \quad (7)$$

and show that n depends only on δ and p_i, and for each $0 \leq p_i \leq 1$ and $\delta \geq 1$ there exists a unique $n_i(p_i, \delta)$ that maximizes equation 7.

The proof is straightforward. Applying logarithmic transformation the expression in 7 becomes

$$P_i(p_i, n_i, \delta) = \delta \ln n_i + n_i \ln(1-p_1) \quad (8)$$

which yields the following first order condition for n:

$$f.o.c. \qquad 0 = \frac{\delta}{n_i} + \ln(1-p_i) \quad (9)$$

and hence

$$n_i = -\frac{\delta}{\ln(1 - p_i)}. \tag{10}$$

The second order condition establishes that for any positive n_i we have indeed found a maximum for n_i:

$$s.o.c. \qquad 0 > -\frac{\delta}{n_i^2}. \tag{11}$$

Q.e.d.

A.4 Prior threshold $\overline{\pi}$

We want to find the threshold prior $\overline{\pi}$ below which it is preferable for individuals to play reciprocity games at the limited scope of cooperation n_2 that is optimal in the informer environment. For this threshold prior we need

$$P(\overline{\pi}, p_1, p_2, n_1, \delta) \leq P(\overline{\pi}, p_1, p_2, n_2, \delta). \tag{12}$$

Let

$$P(\overline{\pi}, p_1, p_2, n_1, \delta) = \overline{\pi}A_1 + (1 - \overline{\pi})B_1 \tag{13}$$

and

$$P(\overline{\pi}, p_1, p_2, n_2, \delta) = \overline{\pi}A_2 + (1 - \overline{\pi})B_2 \tag{14}$$

be the alternative, n-dependent expected payoffs where $A_1 = n_1^\delta \times (1 - p_1)^{n_1}$, $B_1 = n_1^\delta \times (1 - p_2)^{n_1}$, $A_2 = n_2^\delta \times (1 - p_1)^{n_2}$, $B_2 = n_2^\delta \times (1 - p_2)^{n_2}$ denote the partial returns under each strategy, and $n_1 = -\frac{\delta}{\ln(1 - p_1)}$ and $n_2 = -\frac{\delta}{\ln(1 - p_2)}$ are the optimal reciprocity game sizes in the 'good' world and in the informer society, respectively. Then the threshold prior $\overline{\pi}$ is equal to

$$\overline{\pi} \leq \frac{B_2 - B_1}{A_1 - A_2 + (B_2 - B_1)}, \tag{15}$$

and $0 < \overline{\pi} < 1$ because $A_1, B_1, A_2, B_2 > 0$ and $p_2 > p_1$ (which implies $n_1 > n_2$, and thus $A_1 > A_2$ and $B_2 > B_1$).

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