

Contemporary China through a New Institutional Lens: Three Empirical Studies of
Firm Behaviour and Government Responsiveness

by

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Abstract

This dissertation consists of three integrated papers which apply a new institutional economics (NIE) perspective to understand firm and government choices in contemporary China. Using a fixed effects regression model and a dataset I constructed based on twelve years of data from China's National Bureau of Statistics, the first paper explores the impact of government discretion upon the formation of domestic private enterprises. The main finding is that as the share of provincial government revenue deriving from discretionary fees increases, the stock of firms in the province decreases. Investigating data from an existing World Bank survey of 12,400 Chinese industrial firms, the second paper interacts a measure of property rights security with proxy variables indicating the firm's level of sunk costs. The finding that new fixed asset investment by firms with high sunk costs is systematically more responsive to property rights than that of firms with low sunk costs suggests an important and previously unidentified mechanism by which institutional quality can affect economic performance. Finally, the third paper investigates whether the oft-observed association between citizen access to information and government responsiveness obtains in an authoritarian setting. Using National Bureau of Statistics data, I posit a collective action mechanism to account for the finding that increasing diffusion of information and communication technologies (ICTs) is associated with a composition of government spending that is more responsive to citizen preferences. In sum, the dissertation is an empirical contribution to the study of how institutions and access to information affect the behaviour of firms and governments in contemporary China. Beyond estimating the magnitude of these effects, each paper makes a theoretical contribution to our understanding of how institutions matter for development. The dissertation's broad conclusion is that China's development experience supports the conventional wisdom of an NIE perspective on development.

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I. Introduction

1. Overview

This dissertation consists of three integrated papers which apply a new institutional economics (NIE) perspective to understand firm and government choices in contemporary China. Using a fixed effects regression model and a dataset I construct based on twelve years of data from China's National Bureau of Statistics, the first paper explores the impact of government discretion upon the formation of domestic private enterprises. The main finding is that as the share of provincial government revenue deriving from discretionary fees increases, the stock of firms in the province decreases. Investigating data from an existing World Bank survey of 12,400 Chinese industrial firms, the second paper interacts a measure of property rights security with proxy variables indicating the firm's level of sunk costs. The finding that new fixed asset investment by firms with high sunk costs is systematically more sensitive to property rights than that of firms with low sunk costs suggests an important and previously unidentified mechanism by which institutional quality can affect economic performance. Finally, the third paper investigates whether the oft-observed association between citizen access to information and government responsiveness obtains in an authoritarian setting. Using National Bureau of Statistics data, I posit a collective action mechanism to account for the finding that increasing diffusion of information and communication technologies (ICTs) is associated with a composition of government spending that is more responsive to citizen preferences. In sum, the dissertation is an empirical contribution to the study of how institutions and access to information affect the behaviour of firms and governments in contemporary China. Beyond estimating the magnitude of these effects, each paper

makes a theoretical contribution to our understanding of how institutions matter for development. The dissertation's broad conclusion is that China's development experience supports the conventional wisdom of an NIE perspective on development.

The remainder of this introductory chapter is structured as follows. In Section 2, I outline an institutionalist perspective on development based on the work of Douglass C. North (1981, 1990) and North, Wallis and Weingast (2009). The importance of the discretion available to government officials for the political economy of developing and authoritarian states is emphasized. In Section 3 I review critiques of the existing empirical literature on the effects of institutions on economic performance. Section 4 provides a background on the application of institutionalist thought to East Asia's development generally and to China in particular. Finally, Section 5 introduces the three empirical papers which form the main body of this dissertation, and considers each as a response to the shortcomings of the existing literature as outlined in Section 3.

2. Outlining an institutionalist perspective on development

Development orthodoxy in the postwar period held that capital shortages in developing countries prevented the productive use of natural endowments. The presumed remedy was international aid to address this “financing gap”, as international private capital flows to developing countries were miniscule (Easterly, 2001, 33). Though the effects of aid on growth have been much debated,¹ the implications of a private financing gap must be given due consideration. Where capital unavailability is the relevant constraint, the

¹ For a review of this literature, see Clemens et al. (2012).

marginal return on capital investment should be high. This was the optimistic view expressed in a 1952 report commissioned by the Ghanaian government, which projected that surfacing a road between Tarkawa and Takoradi would increase total output by more than a similar investment anywhere in the United Kingdom (ibid, 26). Why, then, did capital not flow eagerly to developing countries?

The phenomenon of apparent “bills left on the sidewalk” (Olson, 1996) motivated one of the founders of the new institutional economics (NIE), Douglass North, to remark in his work with Robert Thomas upon the fundamental question ignored by most economic historians, namely “if all that is required for economic growth is investment and innovation, why have some societies missed this desirable outcome?” (North and Thomas, 1973, 2). In subsequent work, North and his followers explored the presence of transaction costs as an explanation, and the development of institutions which reduce transaction costs as the fundamental driver of economic growth. In neoclassical models economic exchange is costless and information is freely and completely available, such that mutually beneficial exchanges are always consummated. North, however, viewed transaction costs, or “nonbudgetary constraints” (Lin and Nugent, 1995, 1336) as endemic. Their sources were information asymmetries among potential parties to exchange, the cost in determining the value of the goods or services to be exchanged, and the cost of enforcing agreements over property rights and contractual obligations (North, 1993). Under high transaction costs, exchanges between persons known to each other, of goods whose value are easily assessed, and where there is little time inconsistency between purchase and sale, will predominate. Reducing transaction costs can facilitate

the growth of more complex forms of exchange and the creation of greater wealth. North thus viewed the limiting of transaction costs as the key to the long run performance of economies (North, 1989).²

Given the gains to public welfare of limiting transaction costs, institutions have evolved which structure human interaction and reduce uncertainty in exchange (North, 1991). These may be formal rules or less formal social norms. Naturally, which institutions have the greatest impact on economic activity depends on which transaction costs represent the most binding constraints. North nevertheless highlighted those which increased the mobility of capital, lowered the cost of information and enabled the sharing of risk as of the greatest significance. Where the enforceability of contracts is at issue, the literature has documented a wide array of institutions which are, in some cases at least, consciously adopted to enable the trust which underlies complex transactions³. In some cases, however, it is too costly for private parties to a transaction to enforce compliance with institutions without the intervention of a third party. States, being organizations with a comparative advantage in the provision of violence services, are well-positioned to fulfill this role (North, 1981). The provision of property rights and contract enforcement are of such importance that North has termed the state “an essential precondition for economic growth” (North, 1979, 249) and Bates has advanced the admittedly blunt formulation, “no state, no development” (Bates, 2006, 708). Despite the gains from the provision of institutions that reduce transaction costs, we are confronted with the observation that most states, historically, have not done so. In fact, states often

² This is a broader perspective on transaction costs than that typically associated with somewhat narrower concerns of Coase (1937) and Williamson (1975).

³ See the examples considered in Ostrom (1990).

deploy resources to maintain transaction costs and, rather than encourage entry into markets by new participants, erect barriers to entry. The explanation for this puzzle must begin with the recognition that some actors are in a better position than others to define the institutions that will be enforced by the state (Knight, 1992, 113), and that the institutions which emerge will primarily serve the interests of those with the most bargaining power (North, 1993, 3). Moreover, states agents are in a position to structure institutions so as to achieve their own aims, which extend beyond optimal growth levels. As North recognized, all states face a trade-off between two objectives:

one, to specify the fundamental rules of competition and cooperation which will provide a structure of property rights ... for maximizing the rents accruing to the ruler; two, within the framework of the first objective, to reduce transaction costs in order to foster maximum output of the society and, therefore, increase tax revenue accruing to the state (North, 1981, 24).

Given that states must solve the problem of violence in society by appeasing “violence experts”, regime survival depends on the maintenance of institutions which are inefficient in growth terms, as these institutions, by maintaining transaction costs, generate rents which are distributed to elites in return for political support. Maintaining transaction costs for some enables others to take advantage of the resulting uncertainty and enjoy the fruits of a monopolistic position. North, Wallis and Weingast (2009) explain this tendency by identifying the logic of rule in developing and authoritarian states, or *limited access orders*, wherein elites pledge support to a ruler in return for privileged access to markets on favourable terms. The maintenance of transaction costs for non-elites is essential to this bargain. Thus, for example, property rights will be structured in a

manner that places state officials in a “tollbooth” position (Shliefer and Vishny, 1998; De Soto, 2002; Djankov et al., 2002), giving them the discretion to impose transaction costs on economic agents and thereby extract rents from the populace who must pay to overcome barriers to entry⁴.

Limited access orders must take care that the creation of elite rents does not so discourage economic activity as to reduce the pool of private wealth from which to expropriate. Even among officials stationed in tollbooth positions, then, there are diminishing returns to the exercise of discretion. States therefore face a trade-off between, on the one hand, inclusive institutions which generate optimal growth and wealth which can then be taxed, and on the other, restrictive institutions which assign elite supporters the discretion to impose transaction costs. If institutions are too inclusive, there are no opportunities to exercise discretion and little reason for elites to continue to support the regime. If discretion is too high, elites may expropriate private wealth to such a degree that there is little incentive for private actors to generate wealth. Elites may, as it were, overgraze a non-renewable resource. When this happens, the value of tollbooth positions is reduced and political stability is threatened.

In principle, we can imagine the rational regime as awarding an amount of discretion to state officials just sufficient to incentivize continued political support. In Figure 1 below, complete discretion to expropriate private wealth, as in a purely predatory state, is indicated by 1. At 0, there is a complete absence of discretion in the creation of barriers to entry. Facing a trade-off between political stability and growth, the regime sets the

⁴ I take rents as being created “whenever governmental action interferes with markets to keep prices either above or below competitive levels, resulting in artificially contrived privileges” (Sun, 2004, 11).

optimal amount of discretion, which balances these competing objectives, at the point O_R . The state official (henceforth cadre's) optimum is represented by O_C . The distance between O_R and O_C is accounted for by the cadre's relative lack of encompassing interest in growth, lack of certainty of future opportunities for extraction and lack of certainty that other cadres will restrain themselves from exercising discretion. In sum, cadres will perceive fewer gains from forgoing opportunities to exercise discretion, and so will prefer to exercise a higher level of discretion today. They will, as it were, behave rather more like a "roving bandit" than a "stationary bandit" (Olson, 1993). The regime will deploy resources to incentivize the cadre to move his or her discretion level towards O_R . This might be accomplished through monitoring and the threat of sanctions, but monitoring is costly. In a large, decentralized state like China, we can expect variation across sub-national jurisdictions in the position of O_C , owing to numerous factors, monitoring costs included. In 2006, China was estimated to have 19.91 million bureaucrats (Chou, 2006, 4), which is suggestive of the scale of the monitoring challenge.

Figure 1. Optimal discretion levels



The contribution of North, Wallis and Weingast (2009) is to resolve the apparent puzzle of the persistence of bad institutions with reference to the logic of regime survival in states where the problem of violence has not been resolved through the consolidation in government of a legitimate monopoly on the use of force. This provides a context for interpreting the empirical literature on the political uses of government regulation and barriers to entry. Building on this literature, the contribution of the first chapter is to isolate the discretion of state agents as the key margin constraining the development of growth-enhancing institutions, and on which the political determinants of development should be understood. Discretion is at the heart of the trade-off identified by North between inclusive growth and political stability, and it is the good awarded to elites by regimes in return for political support in limited access orders. Moreover, the extent of discretion observed is indicative of the relative balance of power within the state between the regime and elites. Finally, it clarifies the source of uncertain property rights in developing and authoritarian states from the perspective of private firms. Where those charged with enforcing property rights have excessive discretion over the discharge of their duty, firms will perceive property rights as uncertain. This has implications for firm formation, firm investment, and for long run development outcomes. As such, identifying measures of discretion and conducting empirical studies of its effects are important contributions to the institutional literature on development. In the dissertation's first empirical chapter, I construct a measure of discretion afforded to officials in a jurisdiction as emergent from the incentives of officials and the monitoring costs faced by the regime. The identification strategy of this paper takes advantage of the

inevitable variation in discretion among jurisdictions in a large, decentralized state like China.

The contributions of the current research should be understood with reference to the existing empirical literature on institutions and economic performance. The next section provides a selective summary of this literature and two lines of its critique to which the present research is meant to be robust.

2.1. The empirical literature and its critics

However fruitful Northian institutionalism may be as a theoretical perspective on economic development, its contribution would of course be enhanced by demonstrable empirical relevance. Pande and Udry (2005) identify core papers in the empirical institutionalist literature dating to the late 1990s, including Mauro (1995), Knack and Keefer (1995), Hall and Jones (1999) and Acemoglu, Johnson and Robinson (2001). In the main, these papers and their followers have demonstrated a positive association between institutional quality and economic growth and worker productivity. This literature, however, is vulnerable to construct validity and identification concerns, to which I now turn.

North's broad definition of institutions as rules which reduce uncertainty in repeated social and economic interaction does not readily suggest an operationalization that is amenable to empirical investigation. Nor does the perhaps more instructive conceptualization of institutions as having a transaction cost reducing function immediately suggest an appropriate measure. Moreover, it is not readily apparent that

investigating the growth effects of an all-encompassing operationalization of “institutional quality”, were that possible, ought to be the goal of applied research, as the more diffuse the definition of institutional quality, the less amenable institutions are to policy. More constrained operationalizations reflecting local institutions, however, may come at the expense of the generalizability of empirical findings.

To the problem of relevance we can add questions about the reliability of measures. Consider these challenges with reference to the early work of Knack and Keefer (1995), who operationalize institutional quality across countries with reference to the International Country Risk Guide (ICRG) as compiled by Political Risk Services, a consultancy, and the Business Environment Risk Intelligence (BERI) index, also a consultancy. Though these sources have the virtue of broad coverage across states and years, their relevance is unclear. Nor do they shed light on the mechanisms by which institutions affect economic performance. The ICRG, for example, identifies twelve components from which a country’s risk index is compiled. Each component (for instance, government stability, socioeconomic conditions, law and order) is assessed on a truncated scale, and weighted according to criteria which are unclear. The assessment, that is, appears largely subjective. Worse still, where based on survey responses, it is not clear that respondent heterogeneity has been sufficiently addressed to enable meaningful cross-country comparisons. Consider a survey on the severity of corruption, which is a component of the ICRG index. It is unlikely that all respondents approach a question such as “how serious of a problem is government corruption in your jurisdiction?” from the same baseline. Practices perceived, based on experience, as normal in country A may

strike respondents in country B, similarly based on their experience, as evidently corrupt. The problem is magnified by the use of truncated, ordinal scales. The ICRG corruption scale terminates at a maximum score of six. It is unclear that one can conclude from this data that corruption is equally problematic in two countries which both score a six. If so, this also means that we cannot rightly state that a country scoring six experiences a level of corruption twice as severe as a country scoring three.

As to the implied mechanisms, beyond the assertion that higher values of each component reduce uncertainty, little is offered by the mere demonstration of an association. Even if, for instance, by disaggregating the twelve components and running separate regressions using each it is determined that “law and order” is strongly associated with economic outcomes of interest, this relationship needs further theorizing before it can be relevant to policymakers. An observed association using this operationalization cannot tell us whether we should improve law and order by increasing the number of police in a jurisdiction or adjusting the incentives of the existing force, or whether reform of the judiciary is more appropriate. In sum, then, broad renderings of institutional quality leave us with the concern not only that the proper operationalization of the concept eludes us, but also that where attempts are made, the policy implications of our findings are unclear. This is the view taken by Rodrik (2006), who notes that while “we know that growth happens when investors feel secure, ... we have no idea what specific institutional blueprints will make them feel more secure in a given context” (2006, 979).

More challenging still, these problems of construct validity and external validity exist in the context of findings which are subject to omitted variable bias and endogeneity.

Economic performance, rather than being caused by institutional quality as operationalized in the empirical literature, may in fact be the driver of good institutions. Keeping with the law and order component, it is clear that more prosperous societies may be better able to afford the provision of services which our measures pick up as indicators of institutional quality. Alternatively, both economic performance and institutional quality may be driven by other factors. Where these are country-specific, the policy relevance of cross-country empirical work is doubtful. A final danger is that there is a high degree of collinearity in these composite measures of institutional quality. If this is the case, it will be difficult to distinguish those features of the institutional environment which have a causal impact from those which merely track the feature of interest.

The two related challenges with which empirical research on institutions must therefore come to grips, then, are construct validity and identification. Positive trends can be found in existing research, to which this dissertation hopes to contribute. I briefly consider these developments before turning to the dissertation's distinct contributions.

Subsequent to these initial papers on institutions broadly construed, a literature has developed which investigated institutions more clearly delimited in scope, in the hope of identifying variation in specific institutions which accounts for substantial variation in the economic outcomes of interest. For instance, Acemoglu and Johnson (2005) investigated the relevance of "legal formalism", defined with reference to the number of legal

procedures required to adjudicate a simple dispute. Djankov et al (2002) consider the number of procedures required to legally register a new limited liability corporation as a measure of institutional quality to test the theory that regulations serve a “tollbooth” function. As a final example which inspires the first chapter of this dissertation, consider the work of Clague et al. (1999) who construct an index of institutional quality which they call “contract-intensive money”, which assesses perceptions of institutional quality with reference to the form in which citizens prefer to hold assets. Where contract enforcement and property rights security are lacking, investors are expected to demonstrate a preference for liquid holdings, and an aversion to reliance on contracts. This measure has several virtues. Firstly, it is objective and arises through a large number of discrete choices by individuals. Secondly, it reflects the choices of individuals with a stake in the wisdom of their choice. Even when the assessments of consultancies are based on the views of a broad number of individuals, this incentive is largely absent. Thirdly, the measure is rendered as a percentage and is therefore continuous (though with a zero bound and a maximum value of 100). This enables meaningful comparisons of levels of institutional quality across jurisdictions.

The trend towards more objective measures of institutional quality which also are more suggestive of channels by which specific institutions affect the outcomes of interest may nevertheless be subject to the identification challenges described above. Pande and Udry (2005) suggest that some of these concerns could be addressed through the pursuit of more within-country studies. This approach enables the researcher to control for intrinsic, jurisdiction specific characteristics that are unchanging through time. Where

geography or history have created persistent legacy effects, this is important. The goal, for Pande and Udry, is to isolate the effects of “policy-induced variation in specific institutions within countries to understand how these institutions influence economic activity” (2005, 1). Investigating panel data can facilitate this. Presuming there is variation in the specific institution of interest, in either the timing of its presence in the case of a law or the intensity of the “treatment effect” in an institutional variable which can be measured on a continuous scale, we can include jurisdiction and year fixed effects, along with observed covariates, to “difference away” all but the effect of interest in the manner of a “quasi-experiment” (Meyer, 1995). The empirical work presented in this dissertation aims to be robust to the challenges of construct validity and identification by incorporating the lessons of this recent literature.

3. The case of China

Contemporary China provides an interesting case for further study of these issues. Though there are important differences in the trajectories of the newly industrializing countries of East Asia, it is constructive to place some apparent puzzles of China’s rise in this broader context. The postwar development experience of the entire region has been the subject of considerable debate. Both influential academic work, dating to Johnson (1982) and Amsden (1989), and reviews of the evidence by the World Bank (1993) have presented an interpretation of East Asia’s “miracle” which emphasizes these states’ apparent departure from the conventional wisdom of a strict Northian approach to the role of institutions. Fundamentally, the latter emphasizes the importance of reducing uncertainty about property rights so as to increase private investment. The state, though

it has a role in securing property rights, is simultaneously viewed as an ever present threat to property rights. The more active the state's role in the economy, whether in capital markets, the erection of barriers to entry in some markets, or the direction of investment, the greater difficulty the state will have in restraining its power. Absent constraints, indeed, the state may become predatory, subject to the trade-off described above. Debate about the sources of East Asia's growth has turned on the question of the apparent activism of these states in their economy. According to the now-dominant interpretation, these states managed to be simultaneously interventionist and yet restrained in the exercise of their predatory capabilities. Indeed, rather than predatory states, many East Asian states would seem to have earned the title of "developmental states" (White and Gray, 1998; Woo-Cummings, 1999; Wade, 2004). I first consider the justifications for the interventionist East Asian states and the form taken by these interventions, and then turn to the question of how, given that interventions took place, these states are thought not only to have restrained unproductive intervention but to have engineered a remarkable economic transformation.

Interventionist policy in these states can be seen as a response to a series of market imperfections which complicate the association between secure property rights and investment (Haggard, 2004). Firstly, though more secure property rights encourage some forms of investment, the optimal investment of savings may require simultaneous investments in complementary goods by other firms. When the failure of firms to undertake these complementary investments results from collective action problems, states can consciously adjust the incentives of private investors so that the desired

investments are undertaken. The state, that is, may have a role to play in the coordination of market activities so that the most optimal investment, given available inputs, is undertaken. A related concern is that the returns to investment in a sector are dependent on the existing size of the sector or complementary sectors, and of the geographic clustering of these firms. Government is thought to be capable of facilitating the necessary coordination among private actors so that returns to such agglomeration can be enjoyed. Secondly, the state may intervene in shallow financial markets so as to stimulate investment by banks that would otherwise be reluctant to lend. This can be done by imposing controls on deposit rates and limiting entry into lending markets. Thus compensated, favoured banks are willing to invest in projects the state deems likely to create positive externalities. Thirdly, East Asian states understood development as in large part a question of technological learning (Studwell, 2013). State intervention is required where private firms, given the uncertainties accompanying large investments in new technologies, and their failure to internalize the associated externalities, would not of their own initiative undertake such learning. In an effort to stimulate such investments, South Korea in particular subsidized technology acquisition by domestic firms.

Broadly speaking, interventions designed to meet these ends take the form of creating rents for some firms or sectors which are enjoyed at the expense of competitors, whether existing or potential. Provided one accepts that this interventionist orientation reflects state policy during the rise of East Asia, one is still left with the puzzle of how these states managed to extend rents to some firms and sectors while making these rents credibly conditional on firm performance in achieving interventionism's social aims.

Where this commitment is not credible, incumbent firms may be in a position to dictate terms to the state so as to maintain their favoured status. In South Korea, strict conditionality was maintained by insisting on export performance in return for privileged status. This ensured that firms which were not competitive by global standards would be “let go”, thereby enabling competitive pressures within the favoured sector despite the limits on domestic competition created by barriers to entry. A related challenge is how these developmental states managed to restrain themselves in the face of the opportunity to award rents to firms and sectors based on favouritism for well-connected elites rather than those where social returns were highest.

Selective interventions by the state and the favouring of some firms and industries amounts, in Northian terms, to a deviation from the preferred approach to property rights, where these rights are enjoyed by all economic agents on an anonymous basis. On an equal institutional footing, investment should flow to its most productive uses regardless of the political standing of its recipients. In terms of theory, these deviations may be justified where property rights certainty and the entry of new firms is not the most binding constraint on development.

The Chinese growth experience presents perhaps an even greater challenge for Northian institutionalism, and the “paradox” of Chinese growth under an apparently deficient institutional regime has attracted wide attention (Yao and Yueh, 2009). Whereas the interventionist regime in South Korea inherited a developed entrepreneurial class, private economic activity before the reforms launched in the late 1970s was illegal in China. The

legal right to private property was enshrined in the constitution only in 2004. In the early reform years, private firms with fewer than seven employees were recognized as legal entities in 1982, and larger private firms in 1988. To this day, firm ownership structures in China are notoriously opaque. Xu (2011, 1077) suggests that there is “no clear separation between government and business”, and Huang (2008) argues that the control rights of many nominally private firms, including limited liability corporations, are in fact held by government. In recent empirical work, Wang (2013) describes such firms as being of “mixed” ownership status. Thus relations between the state and business in China are not directly comparable to that found in other East Asian industrializers. A further indication that China’s intervention in markets in contradiction of conventional best practice deviates from the East Asian experience is persistent attempts by the central government to exert greater control over the assignment of rents by subnational governments. That this process must be controlled suggests that the Chinese experience is not merely one of a coordinated industrial policy directed by a strong central state such that rents are awarded to firms and sectors where the expected social gains from this favoured status are highest. Rather, there is substantial evidence that the process generating the awarding of rents in China is driven by the private incentives of subnational state agents. Indeed, there is considerable debate over the extent to which the central government is able to control local officials (Edin, 2003).

Economic decentralization is a hallmark of the Chinese reforms. Decentralization has reached such an extent that some have described the Chinese system as a form of “de facto federalism” (Fuller, 2007), and the World Bank (2002) estimated that nearly 70% of

Chinese public expenditure is undertaken by subnational governments. This decentralized structure need not bode ill for the fortunes of an interventionist state. If, following Stiglitz, we take a “helping hand” from government as beneficial “whenever markets are incomplete or information is imperfect” (Stiglitz, 2003, 8), then local officials should be better placed to efficiently coordinate investment based on access to jurisdiction-specific information. Local awarding of rents and setting of investment priorities should imply minimal deviation from local comparative advantage. Local officials may also be expected to be better informed about citizen preferences, and thus in a better position to set local development priorities to which the awarding of rents is meant to contribute. At the national level, the decentralization of economic decision making is thought to have positive second-order effects as well. Firstly, the coordination of investment priorities at the local level minimizes the effect of policy failures on the national economy as a whole. Secondly, bold reforms which may endanger privileges enjoyed by beneficiaries of the status quo may be more feasible politically at the local level. Once deemed to have been locally successful, stakeholders in other jurisdictions may be more easily convinced of the desirability of reform. This “experimental” approach to reform may have been especially important in China given that state intervention meant to be “market supporting” represented a dramatic departure from the Maoist, pre-reform period.

A further benefit of decentralized economic decision making is thought to follow from the maintenance of a centralized political structure in China. Personnel appointments remain in the hands of the central state. There is substantial evidence that economic

performance is the primary criteria on which regional leaders seeking promotion are evaluated (Edin, 2003; Chen et al, 2005 in Xu 2011). When contemplating economic interventions, then, local officials have an incentive to award rents with an eye to economic growth rather than to the preferences of influential allies. This should engender competition among jurisdictions to offer an interventionist program which is market supporting rather than predatory. Indebted to a Tiebout model (1956) showing how jurisdictional competition can lead to the efficient provision of public goods, this competition among local officials in China has been conceived as a form of “market preserving federalism” (Montinola, Qian and Weingast, 1995; Qian and Weingast, 1997).

In practice, such an arrangement is vulnerable to several perversions. With local discretion over the construction of barriers to entry and the awarding of rents, there is a danger that the rewards to local officials in self-enrichment through the distribution of rents to the politically favoured will exceed the foregone benefits of professional promotion. The former is particularly attractive to lower level officials who have not had the opportunity of more senior leaders to reap such benefits. Moreover, such officials have, by comparison, less certainty of future extractive opportunities as the promotion process is subject to uncertainty. Perhaps more fundamentally, as discussed with reference to Figure 1 above, lower level officials have less of an encompassing interest in growth than higher level officials, and the benefits foregone through the exercise of restraint are weighted more heavily than the political dangers of the predatory state. There is ample evidence that Chinese state officials exercise their discretion in pursuit of individual goals, rather than those of the developmental state. In the reform years,

barriers to entry erected by subnational officials exceeded the aims of the developmental state, proliferating so that local firms could be protected even from competition from Chinese firms in other jurisdictions. Fuller refers to mayors of large Chinese cities as “economic warlords” who oversee their local “fiefdoms”, erecting protectionist barriers to ban firms from other jurisdictions from competing with local incumbents (Fuller, 2008; Wedeman, 2003; Yang, 2004). These measures have, on occasion, risen to alarming proportions. “In one case, an escalating trade war between Guangdong and Hunan led to the deployment of troops to stop the outflow of rice to surrounding provinces” (Fuller, 2008, 555). Even if the intended goal of rent creation is to facilitate the growth and technology acquisition by favoured firms, these objectives are jeopardized when state agents freely exercise their discretion to extract rents from firms. Under “free entry” into the barrier creation game, rents accrue not to their intended beneficiaries but to local officials. Kumar (1994) emphasized the discretion available to local officials in awarding benefits to firms. Though this might follow from the decentralization of economic decision making, it is difficult to square with the observation that many of these benefits were considered illegal by the central government (Kumar, 1994, 48). Perhaps, then, as Huang (2008) suggests, China does not present a challenge to the conventional wisdom of Northian institutionalism. The empirical findings presented in this dissertation are taken as evidence for the relevance of Northian institutionalism as a perspective which illuminates essential features of China’s contemporary political economy.

4. The current research

Northian institutionalism and the challenges of conducting empirical research motivated by this perspective provide the theoretical background for the dissertation's three empirical papers. Each paper takes contemporary China as a case study. It is hoped that these papers simultaneously rise to the construct validity and identification challenges faced by empirical investigations into the role of institutions and shed light on the mechanisms by which institutions affect economic performance. The first two papers present evidence that private firms are responsive to levels of government discretion, that firm investment levels are responsive to the perceived security of property rights, and that this effect is stronger among firms characterized by high sunk costs. The final paper considers whether, despite the incentives of state officials, the diffusion of information and communication technologies (ICTs) can incentivize more responsive government. This paper breaks new ground by extending the observed link between citizen access to information and government responsiveness to an authoritarian setting. In the remainder of this introduction, I provide a brief summary of each of the empirical papers to follow, emphasizing their relevance in light of the institutionalist perspective and scholarship on contemporary China.

4.1. First paper

“Does government discretion affect the number of firms in a jurisdiction?

Evidence from Chinese panel data, 1998-2009”

Motivated by the frequent observation that China's regulatory regime is characterized by discretion at local levels (Kumar, 1994; Pearson, 2007), the first paper investigates whether variation in discretion across Chinese provinces is associated with variation in economic performance. Discretion is operationalized as the share of provincial government revenue deriving from "charges of administrative units".⁵ As I document, these discretionary charges have long been a source of frustration among Chinese private enterprises and the central government. This highlights the challenge of managing the incentives of elites through the distribution of rents while simultaneously encouraging economic activity among private actors. Treading this fine line is more difficult still when the aims of the developmental state require the discretion among officials to award rents to incumbent firms. As documented below, variation in our measure of discretion at the provincial level is significant. This facilitates estimation of discretion's impact on the decision making of private actors, and also reflects variation in the cost to the center of enforcing its preferred level of discretion across all provinces.

I estimate the effect of discretion on the stock of domestic private enterprises in each province using panel data covering the period 1998-2009. Private enterprises have been demonstrated as being more productive than state owned enterprises (SOEs), collective enterprises and firms of "mixed" ownership status (Huang, 2008). Given the potential for state-affiliated firms, which face soft budget constraints and objectives beyond profit maximization, to become sclerotic, the development of the domestic private sector is an important precondition for China's continued growth as the days of "catch-up" growth

⁵ The relevant dataset has been compiled by the author based on data from China's National Bureau of Statistics.

based on cheap labour fade. Results indicate that a one percent rise in discretion is associated with one fewer domestic private enterprise per 10,000 provincial residents. This result is robust to the inclusion of a number of observed covariates and the inclusion of province and year fixed effects. It is also robust to an adjustment of our operationalization of discretion to “charges of administrative units” in absolute per capita terms, rather than as a percentage. Interestingly, Chinese data allow us to distinguish between two types of private enterprises, private enterprises (*siying qiye*) and individual/household enterprises (*getihu*). The stock of the latter observed in a province does not appear sensitive to discretion levels. This is suggestive of a mechanism by which institutional quality affects firm decision making which I pursue further in the subsequent chapter. Furthermore, the paper incorporates into its analysis the role of an important budgeting reform introduced by the central government which the China literature has largely ignored. This reform, *shouzhi liangtiao xian*, mandates the separation of administrative departments’ collection of revenue from administrative fines and fees from the spending of such revenues. As I argue within the paper, this reform should exert downward pressure on the collection of fees. It is therefore important as a plausibly exogenous source of variation in discretion levels as it was implemented over the objections of local officials. At the same time, however, these objections are the source of halting and uneven implementation. This prevents an estimation of clear before and after effects of the reform on discretion, but as such is nevertheless suggestive of both the central government’s dissatisfaction with existing discretion levels and of the variation of discretion levels across provinces. The sources of province’s ability to resist

implementation of the reform, though not evaluated in the paper, are discussed in the dissertation's conclusion.

In sum, the paper provides clear evidence of an association between discretion and the formation of domestic private enterprises. As such, it shows that an association can be demonstrated between an objective operationalization of institutional quality and an important component of economic performance. In operationalizing institutional quality with reference to discretion, the paper makes the case that discretion is at the heart of North's trade-off described above and that while the measure adopted here arises from a large number of discrete choices, it reflects the broader balance of political power within a limited access order. As such, it is a useful concept that might motivate future studies of the role of institutions. Attention to country-level manifestations of discretion is warranted in future work so that the general relevance of this concept to institutional analysis can be further established.

4.2. Second paper

“Property rights and investment among Chinese firms: The importance of sunk costs”

Though the first paper has introduced a unique measure of institutional quality, its effects are measured only at the aggregate level. Moreover, the effects of discretion on firm choices are observed only along one margin, the decision to enter the market. Moreover, examining a comprehensive dataset such as that employed here enables us to determine

whether the effects of institutions on firm choices are conditional on other variables. This is the goal of Chapter 2.

Using data compiled by the World Bank's 2004 nationally representative survey of 12,400 Chinese industrial firms in 120 cities, I investigate first whether firms' new investment in fixed assets is responsive to the perceived security of property rights. Using an options model of optimal investment as described by Hirshliefer (1979; 1989), Dixit (1989, 1992), Dixit and Pindyk (1994) and List and Haigh (2010), I hypothesize that firms experience a reward for deferring investment when uncertainty is present and reduced over time, investment can be postponed, and a portion of the contemplated investment is irreversible (i.e., sunk), undertaking an investment when the expected return on the investment exceeds a "hurdle rate". Where the source of uncertainty is insecure property rights, in which the directional effect on expected returns is more clearly biased downward, the effect ought to be stronger still. Using two proxies for sunk costs, I demonstrate the importance of the irreversibility component of these options models. This is done by including in the regression analysis terms which interact property rights with sunk cost variables. As sunk costs rise, a given increase in uncertainty about the security of property rights predicts a larger reduction in investment.

By providing empirical evidence that the institutions-economic performance link is conditional on sunk costs, the paper makes two contributions to the literature. First, it identifies a clear causal pathway by which institutions affect firm performance, and one that is cognizant of heterogeneity across the population of firms. Secondly, this in turn

presents a policy-based explanation for the location choices of firms across jurisdictions, and for the clustering of particular industries in particular jurisdictions within China.

4.3. Third paper

“Does ICT diffusion increase government responsiveness in autocracies? An empirical assessment of the political implications of China’s internet”

Given the capacity of states to impose transaction costs upon citizens, and the view outlined above that existing institutions reflect the interests of those parties in a position to shape institutions to suit their aims, one might despair over the possibility of institutional reform. A growing literature has documented, however, that increasing citizen access to information, in some cases driven by technological shocks, is associated with more responsive government⁶. Where the incentives of state agents are sensitive to citizen information access, there is hope that states will be motivated to reduce transaction costs and construct a set of institutions more favourable to the maximization of citizens’ welfare. The dissertation’s third paper evaluates whether the oft-observed association between citizen access to information and government responsiveness can obtain in an authoritarian context. To do so, I compile a dataset covering the years 2001-2010 using National Bureau of Statistics data and employ fixed effect regressions to estimate the effect. I find that in provinces with higher levels of ICT diffusion, governments devote a greater share of expenditure to health and education, and a lower

⁶ For a review of this literature, see Prat and Stromberg (2013).

share to capital construction. The finding is robust to the inclusion of observed covariates including, in the case of health and education spending, elderly and youth dependency ratios. The findings are also robust to the inclusion of province and year fixed effects.

The paper makes several contributions to existing scholarship. First, it is to my knowledge the first within-country study which seeks to determine whether even authoritarian governments are more responsive to better informed citizens. Secondly, though there is considerable debate as to the political implications of China's internet, there have been very few attempts to pursue this question empirically. Finally, I suggest a collective action mechanism to account for the paper's findings. Previous studies, focusing on democratic states, have relied on electoral mechanisms to account for officials' incentives to provide more responsive government. The collective action mechanism described here has explanatory value not only in authoritarian societies where electoral mechanisms are absent, but, I argue, is of general relevance where information costs are falling.

5. Summary

In sum, these papers are submitted as empirical contributions to the literature on institutions and development. To the concern that existing measures of institutional quality are subjective, the first paper presents government discretion as an objective operationalization of institutional quality reflective of the incentives shaping a large number of discrete choices. As such, it is submitted as preferable to the subjective valuations of consulting firms. To the concern that existing studies of the association

between institutional quality and economic performance are vulnerable to identification problems, I undertake within country studies in an effort to account for unobserved heterogeneity across jurisdictions. In response to the concern that aggregate data does not enable robust conclusions about the effects of institutions, paper two employs a large firm-level dataset to estimate the effect of perceived property rights security on investment levels. More broadly, in response to the concern that we lack an understanding of *how* institutions matter for development, papers one and two investigate the association between institutional quality and specific aspects of economic performance, i.e., firm formation and firm investment. To this end, the first paper provides a detailed account of a manifestation of discretion that is particularly concerning to firms, and the second paper makes a unique contribution by demonstrating that institutions matter differently to different types of firms. Finally, the third paper breaks new ground by exploring ICT diffusion as a potential source of institutional change. In general terms, then, the dissertation is an elaboration of the Northian perspective on institutions, demonstrating empirically that institutions matter to clearly defined measures of economic performance. The relevance of institutions to development policy is thus further established by this dissertation. Moreover, the dissertation contributes to our understanding of the apparent “China puzzle”. My findings indicate that the behaviour of Chinese firms does not contradict a conventional, Northian understanding of institutions, indicating the continued relevance of this perspective for students of development policy in the contemporary world.

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*II. Does government discretion affect the number of firms in a
jurisdiction?*

Evidence from panel data on Chinese provinces, 1998-2009

ABSTRACT

In developing and authoritarian states, government officials in tollbooth positions have the discretion to establish barriers to entry into market activity. Entrepreneurs experience this discretion as a source of uncertainty which reduces expected returns and thus deters firm formation. This paper runs fixed effects regressions on panel data to estimate the effect of government discretion on the number domestic private enterprises in Chinese provinces. Defining discretion as the share of provincial revenue deriving from charges levied by government departments, the paper finds that a one percent decrease in discretion is associated with an additional private enterprise for every 10,000 provincial residents.

Key words: entrepreneurship, regulation, institutions, uncertainty, firms, China

1. Introduction

Public choice theories of regulation can contribute to our understanding of the mechanics of regime stability in developing and authoritarian states. In such societies, which North, Wallis and Weingast (2009) call *limited access orders*, regimes award elites access to markets in return for political support, and erect barriers to entry which limit competition from new firms. While unlikely to be optimal in growth terms, this practice creates two sets of winners who form the basis of regime support: incumbent, state-favoured firms, and state officials stationed in “tollbooth” positions (De Soto, 2002; Shleifer and Vishny, 1998; Djankov et al., 2002). My focus in this article is on the latter. Tollbooth positions imply discretion on the part of officials in the creation and sale of government goods required to enter markets. Discretion is therefore a source of uncertainty for entrepreneurs considering establishing firms, as it implies both barriers to entry today and uncertainty about future regulatory burdens. This paper attempts to assess the magnitude of the effect on firm formation of the discretion awarded to local government officials in the regulation of private enterprises. Operationalizing discretion as the share of government revenue in Chinese provinces deriving from discretionary charges levied by government departments, the paper uses variation in discretion levels in a panel data set covering twelve years to estimate the effect of discretion on the number of domestic private enterprises in a province.

China’s fragmented regulatory regime is reflective of the discretion that has been afforded to local officials in the establishment of discretionary charges, of which private enterprises have been frequent targets. The Chinese central government has, in the

period studied here, attempted to reduce the discretion of local officials through law. In this paper I focus on one such initiative, known as *shouzhi liangtiao xian* (“two separate lines in revenue and expenditure”), which mandated the elimination of “extra-budgetary” accounts held by local governments, and which is a plausible source of variation in discretion levels across provinces over time. These dynamics make China an interesting case study to evaluate the relationship between discretion and firm formation. The main finding reported below is that in panel data covering China’s 31 provinces for the years 1998-2009, a one percent reduction in discretion is associated with an additional private enterprise for every 10,000 provincial residents. This result is robust to an alternative measure of discretion, and the inclusion of both observed covariates and province and year fixed effects. Our findings also indicate that entrepreneurs respond differently to the burden imposed by discretionary fees than to the burden imposed by taxation. Finally, our results suggest that discretion has selection effects on the type of firm operating in a given jurisdiction, as the effect of discretion on smaller, household enterprises is inconsistent across specifications.

Given that the sources of variation in discretion levels in the sample are not strictly exogenous, the paper stops short of claiming a causal interpretation of these results. Nevertheless, it represents two important advances. Firstly, in terms of theory, it develops the claim that the amount of discretion afforded to state agents in the shaping of the regulation of private economic activity is at the heart of the political economy of development as understood from a new institutional economics (NIE) perspective. This

represents a bridge between the theoretical advances of Northian strands in the NIE⁷ and a policy-focused approach to the question of the relative importance of rules versus discretion in the regulation of business⁸. Secondly, the paper represents an empirical advance in arriving at an operationalization of discretion that is simultaneously driven by the incentives of state agents and the monitoring powers of their superiors, and affects the level of uncertainty faced by entrepreneurs. The paper complements the existing empirical literature on the effect of regulatory barriers to entry on firm formation and performance not only by advocating the importance of government discretion as a variable of interest, but by emphasizing *de facto* barriers to entry rather than *de jure* barriers⁹.

The paper also speaks to prominent debates in the China-specific literature on the private economy. Nee and Opper (2012) emphasize the halting and uneven process by which the Chinese state has recognized the existence and value of the private economy in law¹⁰. They claim that this derives not merely from the political sensitivity of private enterprises or the threat that the entry of private firms into protected markets represented to the rents enjoyed by state-favoured incumbents. Rather, it speaks to the absence of government policy as a driver in the rise of the private economy, which at each stage of its development has been a *de facto* reality before it was recognized as such in law. In this view, the main institutions supporting the private sector are evolved responses originating

⁷ Key advances in this tradition include North and Thomas (1973), North (1981, 1990), and North, Wallis and Weingast (2009).

⁸ To date, the literature on rules versus discretion has been largely focused on the virtue of flexible financial and monetary policies (e.g., Kydland and Prescott, 1977; Barro and Gordon, 1983). The NIE literature suggests that this is an important margin in the making of business regulation as well.

⁹ The barriers to entry literature is discussed further in the next section. The standard approach dates to Djankov et al. (2002). For a review of subsequent findings, see Djankov et al (2009). For more general institutionalist perspectives on entrepreneurship levels, see North and Thomas (1973) and Baumol (1990).

¹⁰ See also Milana and Wang (2013, 389) on this “zigzag process”.

among entrepreneurs themselves, of the sort described by Ostrom (1990). Though the findings presented here do not contradict this view, they suggest that Nee and Opper's insights do not mean that government policy cannot be a binding constraint upon the choices of entrepreneurs. Rather, taking the discretion available to state agents as our constraint of interest, a clear association with firm choices is demonstrated.

The paper is also relevant to the debate on the benefits of economic decentralization in China. Qian and Weingast (1997), for instance, argue that the decentralization of decision-making to local government officials set off jurisdictional competition that, far from protecting incumbents, was supportive of private markets. Indeed, Qian and Weingast tout the granting of "extra-budget" accounts to provincial government, a component of which are the regulatory fees used here to operationalize discretion. Not having knowledge of the extent or sources of this revenue, the central government could credibly commit not to tax it, "which in turn encourages local governments to generate prosperity and revenue" (Qian and Weingast, 1997, 86). Though a comprehensive assessment of the merits of the decentralization of economic policymaking in China is beyond the scope of this paper, the evidence provided here should make us less sanguine about the incentive effects of these revenue sources as it relates to the growth of China's private sector.

The remainder of the paper is structured as follows. Section 2 reviews the literature relating to government discretion and presents a mechanism whereby the uncertainty generated by discretion affects the incentives of entrepreneurs. In Section 3 I describe the discretion available to local branches of China's State Administration of Industry and Commerce (SAIC) to impose fees on private enterprises, and the resulting burden on

firms. The implementation of reforms designed to reduce this discretion, known as *shouzhi liangtiao xian*, is also documented. In Section 4 I describe the data and outline an estimation strategy to identify the relationship between discretion and firm formation. Results are presented in Section 5. Section 6 concludes with a discussion of the policy implications of our findings.

2. Literature review and theoretical framework

In developing and authoritarian states, or what North, Wallis and Weingast (2009) call *limited access orders*, regimes are cognizant of the trade-off between wealth maximization and political stability (North, 1981) when awarding discretion to local state agents over the regulation of private economic activity. The continued loyalty of these agents is bought with the awarding of discretion over the regulation of private economic activity in the form of “tollbooth” positions (Shliefer and Vishny, 1998; De Soto, 2002; Djankov et al., 2002). Discretion results in the erection of barriers to economic entry which protect the monopolistic position of state-favoured firms. Moreover, by holding discretion over the regulatory barriers new entrants must overcome, state agents are effectively local monopolists in the supply of regulatory goods. As such, they reduce the supply of property rights required to operate a business, effectively taking otherwise mutually beneficial deals between firms and their consumers off the table. Firms will pay to put such deals back on the table, and state agents are the primary beneficiaries of these payments. By keeping the cost of entry high, discretion creates rents both for state-favoured incumbent firms for the suppliers of artificially scarce property rights.

Since the pioneering work of Djankov et al. (2002), efforts have been made by the World Bank to assess the effect of business regulation on entrepreneurship in its *Doing Business* series. The academic literature has consistently demonstrated an association between barriers to entry and entrepreneurship. For example, investigating European data, Klapper et al. (2006) show that costly market entry regulations affect the creation of new firms, the average size of these entrants, and the growth of existing firms. In a cross-country study of employment growth, Ciccone and Papaioannou (2007) find that decreases in the length of time required to register a new business are associated with higher entry levels. Additional cross-country work by Dreher and Gassebner (2013) found that both the number of procedures required to register a business and initial capital requirements have a negative impact on entrepreneurship. I contribute to this empirical literature by emphasizing that barriers to entry reflect the discretion available to local state officials in the regulation of private enterprise, and by developing a *de facto* measure of discretion with reference to the fees paid by firms to meet the licensing and regulatory requirements imposed by local officials. Moreover, though there have been previous attempts to measure the effect of institutional quality on the investment behaviour of Chinese firms¹¹, this is the first paper to focus explicitly on the effect of government discretion on firm formation.

In China, local government discretion in the regulation of the private economy is manifested in the establishment and collection of licensing fees, fines and levies. Firms are required to purchase these property rights goods at the price set by the local monopolist. How serious is the burden posed by these discretionary fees for

¹¹ See, for instance, Hallward-Driemeier, Wallsten and Xu (2006), Lin, Lin and Song (2012) and Lu, Png and Tal (2013).

entrepreneurs considering entering a market? At first glance, the impact of these fees might be thought of as akin to the impact of taxes on enterprise income, insofar as increases in each reduce the entrepreneur's expected returns. Forward looking firms, however, care not only about today's costs but also act on expectations about tomorrow's costs. Financial burdens whose severity is determined by a local monopolist imply greater uncertainty about future costs than do taxes which local officials do not have the discretion to raise or lower, as is the case in China (Chou, 2006, 7). This uncertainty is exacerbated where firms are required by law to obtain licenses and permits supplied, and indeed, created, at the discretion of the local monopolist. There is therefore uncertainty both as to the number of licenses that will be required in the future and the cost of acquiring these. As has been shown by Hirshleifer (1989), Dixit (1992) and others, so long as investment can be deferred to a later time and some proportion of the contemplated investment is irreversible, the presence of uncertainty creates a reward for deferring investment. It seems likely that this is especially true for the marginal step of starting a new firm, where market uncertainty of the kind considered by these authors is likely to be highest. Under conditions of property rights uncertainty, as generated by discretionary provision of property rights by local monopolists, the downward effect of uncertainty on both investment and firm formation is likely stronger than where uncertainty merely generates variation around mean expected returns, as in the case of market uncertainty.

The effect of discretion levels on firm formation can be conceived as a geographic location choice, along the lines of the border effects model in Holmes (1998)¹². Assume entrepreneurs have the option of starting a firm in one of two jurisdictions, A and B. Assume that productivity, and thus profits, are uniformly distributed across the two jurisdictions, that wages are competitive and that workers are mobile. In jurisdiction A, the firm faces higher levels of government discretion than in jurisdiction B. We can allow the total present government-imposed burden, in the form of discretionary fees and taxation, to be the same in A and B, but the share of this burden deriving from fees which a local monopolist has the discretion to impose is higher in A. Assuming the existence of discretion today implies greater uncertainty about future burdens than do tax levels which the local official is not able to raise, the firm is not indifferent to this composition and the net present burden of discretionary fees are is subject to an uncertainty “multiplier”. The impact of discretion, d , on the location choice of firms depends on the firm’s initial preferred location. Let this preferred location be A in our example. The firm has the option of relocating (or, in the case of a new business, establishing the firm) to location B. This move implies costs in deviating from the otherwise ideal location. Yet for each entrepreneur, there is a point of indifference between the costs of moving from A to B and the benefits of avoiding the higher discretion to which one is subject in A. More formally, let the ideal location equal y^a and the alternative location equal y^b . The cost of moving one unit of distance is k . Thus the cost of relocation or deviation from the

¹² With the important distinction that Holmes estimates the effects of sharp policy discontinuities at the borders between US states. Though discretion as constructed here is a property of Chinese provinces, it need not be the case that there is an abrupt discontinuity in the discretion available to local officials as one crosses provincial borders. Rather, discretion as measured here is an emergent property of the charging of regulatory fees by officials throughout the province. It need not be the case that levels of discretion are constant throughout a province, nor, then, that the only relevant discontinuities are at provincial borders. The Holmes model is thus employed here as illustrative of firms’ decision-making process and cannot be used for estimation in a regression discontinuity design.

ideal location to the alternative location is $k^*(y^a - y^b)$. This cost is weighed against the benefits of lower discretion, d , in jurisdiction B. This difference in discretion is represented by the term $d^*(y^a - y^b)$. Indifference between jurisdictions A and B can thus be represented as follows:

$$d^*(y^a - y^b) = k^*(y^a - y^b) \quad (1)$$

Any further reduction in discretion in location B attracts the marginal firm who, previously indifferent, is now willing to bear the costs of relocation. Similarly, further rises in discretion in A encourage the previously indifferent firm to relocate. Reductions in the cost of relocation will have the same effect on the choice of the marginal firm, holding discretion constant. Note that while this has been presented as a firm's relocation choice, the model is equally capable of representing the choice of an entrepreneur with an ideal, if hypothetical, initial location choice.

With the uncertainty-raising effects of discretion on firms' expected return calculations, and thus on their preferred operating location, in mind, we turn now to the burden of discretionary fees on Chinese domestic private enterprises in the years covered by our dataset.

2.1. Government discretion and private enterprises in contemporary China

The discretion available to local governments has its roots in China's decentralized political economy. Though nominally a unitary state, the relationship between China's

central government and its provinces has been characterized as amounting to “de-facto federalism” (Fuller, 2007). China is certainly a decentralized state. Nearly 70% of all government expenditures in China are undertaken by sub-national level governments, a significantly higher proportion than in federal Germany or the United States (OECD 2006). Though this decentralized structure has long-standing sources (Naughton, 1995; Xu 2011), decentralization of economic decision-making was an important feature of the period dating to Deng Xiaoping’s reforms and has been credited as an important factor in China’s development insofar as it has created incentives for local governments to pursue growth-friendly policies (Qian and Weingast, 1997; Che and Qian, 1998; Montinola, Qian and Weingast, 1995), though this interpretation rests on assumptions about factor mobility and the credibility of centre-local tax regimes, and has been challenged (Cai and Treisman, 2006; Xu 2011; Tsui and Wang, 2004).

In the wake of this granting of discretion to sub-national officials in the setting of economic policy, a regulatory environment emerged that was fragmentary and characterized by ambiguous lines of authority (Kumar, 1994; Pearson, 2007). Furthermore, since the 1994 tax reforms, provinces have ceded authority in the establishment of new taxes to the central government. This has incentivized local officials to tap sources of extrabudgetary revenue (Tsui and Wang, 2004), which takes the form of fees, fines and levies which agents of local government ministries and departments had the discretion to impose and collect as they saw fit. Such revenue could then be spent by these same administrative units without being remitted to provincial finance bureaus, and departments had the discretion to establish bank accounts to house these funds (Ang, 2009). Not surprisingly, this discretion to impose fees and fines

“generate(d) numerous rent-seeking opportunities for bureaucrats” (Yang 2004, 152). It has been estimated that in the late 1990s and early 2000s, between 63 and 69% of revenue from fees went to officials in the form of spending on government administration (Martinez-Vazquez et al, 2008). Lo and Tang (2006) found that 60% of the fees and fines collected by an Environmental Protection Bureau in a Guangdong city were retained for the bureau’s own expenses, and Chou (2004, 230) found that between 70 and 85% of bureaucrats’ total income derived from “subsidies” funded by these revenue streams. Indeed, to find otherwise would be surprising, given that wages are thought to form the majority of local government expenditures (Liu et al., 2006).

Private enterprises have frequently been appealing targets for fee extractors (Chen et al 2011). Choi (2009) notes that local governments have had “considerable discretion in establishing the nature and size of fees to be paid by enterprises under their jurisdictions” (2009, 80). The regulation of private enterprises in China falls within the purview of local branches of the State Administration of Industry and Commerce (SAIC)¹³. They define the procedures required to legally register a new business and the licenses required to do so. Licenses must be renewed annually (Choi, 2009). Many authors have noted that officials in SAIC branches have utilized their discretion in the provision of business licenses to extract unauthorized payments from applicants (Odgaard, 1992; Yang, 2004). In a survey of the managers of private Chinese firms, licenses were reported as the most significant barrier to entry (Garnaut et al., 2001, cited in Chou, 2006). Field interviews by Choi (2009) found that in one city in Zhejiang province, the SAIC bureau “had around 200 officials and that every official had responsibility for collecting fees from firms”

¹³ In English translation, this body is sometimes referred to as the Industrial and Commercial Bureau. I use SAIC throughout the paper for convenience.

(Choi 2009, 86). In a national survey of entrepreneurs, 50% of respondents identified fee extraction as a source of grievance (Choi 2009, 80). Choi also notes that, “Provincial branches of the Federation of Industry and Commerce ... a quasi-governmental organization representing medium and large private enterprises, have also singled out exorbitant fee extraction as a serious problem for private enterprises” (ibid).

The amount of fees charged by government units within a province, the SAIC included, has been subject over time to shifts in central government policy. By the mid-1990s, concerned by the difficulties these uncontrolled revenue streams posed for coherent national budgeting priorities, a recentralization of government finance began under pressure from the central government (Yang, 2004; Mertha, 2005; Luo, 2008). These reforms improved central government oversight of sub-national government finance, and were an attempt to reduce the relevance of extrabudgetary fees and levies to sub-national governments. They amount to a move toward taxation, as opposed to fees, as a revenue source (Guo 2008, 66), and, indeed, to a furtherance of government by rule of law rather than discretion (Zou 2006)¹⁴. Of particular interest to us here is the Financial Regulations on Administrative Units, first issued by the Ministry of Finance in 1998. These regulations called for the implementation of *shouzhi liangtiao xian*, or “two separate lines in revenue and expenditure” (Zou, 2006, 17; Yang, 2004; Mertha, 2005, 801). This innovation entails separation of the collection and spending of revenue from fines, fees and levies¹⁵. The consequences of its gradual implementation have been called “far-

¹⁴ See also State Council (2002) for an explicit reference to this effect. Translation in *Chinese Law and Government*, Vol.37, 2, 2004.

¹⁵ A complete list of the provisions of the policy, taken from a 1999 circular from the National Audit Office, can be found in Zou (2006). The 2002 State Council document clearly prohibits the setting up of “extra-budget accounts” and mandates the implementation of *shouzhi liangtiao xian*.

reaching” (Tsui and Wang, 2004), and the policy is an important source of variation in discretion levels across time.

Whereas previously, administrative units’ enforcement agencies collected fees directly, *shouzhi liangtiao xian* requires collectors to issue payment forms, printed by the government finance department, to the payer. The payer then deposits the fine directly in a bank account monitored and managed by the finance bureau at the same administrative level as the collecting agency. Once paid, the fined party is issued a receipt which is then taken to the collecting unit as proof of payment (Mertha, 2005, 801). The finance bureau acts as a third party to the fine payment transaction, and departments are required to maintain “zero-balance” accounts, updated daily. The State Council, China’s highest executive and administrative body, summarized the changes that follow the implementation of *shouzhi liangtiao xian*:

After the “two lines for revenues and expenditures” reform deepens, all departments must strictly implement the State Council’s relevant regulations and pay the revenues from fines and confiscations, from administrative type fees, and from extra-budgetary funds promptly and in full to the national treasury or to the extra-budgetary fund specific financial accounts. Transferring and intercepting funds is strictly forbidden. Privately setting up transitional revenues accounts and holding back on payments are strictly forbidden. Diverting funds and paying out revenues on one’s own is strictly forbidden. Privately sharing funds or using funds without authorization for employee welfare is strictly forbidden. Devolving the powers of collection enforcement and penalties enforcement to affiliated institutions is strictly forbidden (State Council 2002)¹⁶.

This policy can be expected to have two effects. The first may account for some of the variation across time in the discretion available to Chinese officials, which I document

¹⁶ Translation in *Chinese Law and Government*, Vol. 37, 2, 2004.

below. The amount of fees collected by administrative units can be expected to decline with the implementation of *shouzhi liangtiao xian*, and the importance of fees in provincial budgets can be expected to decline relative to the importance of taxation. Yang notes that the amount of fines collected in Guangzhou declined from 80m RMB in 1999 to 27m RMB in 2000 after the city adopted *shouzhi liangtiao xian* (Yang, 2004, 243). The mechanism by which this policy disincentivizes fee collection is clear if we note that collection agents were frequently assigned fee quotas by their superiors (Chou, 2006). This implies that collectors received a bonus for meeting this quota, and Yang (2004, 239) notes evidence to this effect in Shenzhen. The State Council itself (2002) noted that this was a common practice. Bonuses were presumably sufficiently high to give collectors an incentive to remit fines to superiors, and not offer payers the option of paying collectors directly (at least to the point that the quota had been met). Under *shouzhi liangtiao xian*, superiors no longer have the opportunity to distribute a proportion of this revenue to collectors, as the revenue is held by the finance bureau. If collectors cannot be reimbursed for the effort of fee collection out of these funds, we can expect the amount of fees collected to decline. Assuming constant revenue needs, we can also expect a substitution of taxation for fee collection as a secondary effect of the implementation of *shouzhi liangtiao xian*. This substitution effect should, all else equal, make a jurisdiction more appealing to entrepreneurs.

The research design outlined in the next section takes advantage of variation in discretion levels, both across provinces and across time, to estimate the effect of discretion on firm formation. Local resistance to the implementation of *shouzhi liangtiao xian* is one source of this variation. The central government mandated the implementation of *shouzhi*

liangtiao xian as early as 1993, by all accounts to little effect. Efforts to impose the policy were “intensified” in starting in 1998 (Choi, 2009, 85). Yang claims that provincial SAIC branches had implemented *shouzhi liangtiao xian* by the spring of 2000 (Yang, 2004), yet the Ministry of Finance complained in 2001 that many bureaus had not in fact implemented the policy. The State Council, the highest political and legislative body in China, saw fit in late 2001 to issue a circular mandating the “deepening” of *shouzhi liangtiao xian*, effective in 2002. Throughout this period of halting implementation, the central government directly involved itself in the abolishing of unapproved, provincial-level fees. Choi cites Chinese sources to the effect that 31,710 types of fees on enterprises were abolished in 1999, and a further 33,456 in 2001 (Choi 2009, 84).

3. Data and estimation strategy

The preceding discussion generates an empirical hypothesis which I evaluate below, namely:

H_1 : Increases in the share of provincial government revenue deriving from Charges of Administrative Units is associated with decreases in the number of private enterprises in the province.

3.1. Variable operationalization and data sources

I construct a panel data set using data from China’s National Bureau of Statistics’ *Chinese Statistical Yearbook* covering the period 1998-2009, and evaluate this hypothesis

using a fixed effects model. In the remainder of this section, I describe the operationalization of my independent and dependent variables. I then sketch a ‘naive model’ illustrating the hypothesized relationship between discretion and the number of firms in a province. Possible sources of omitted variable bias are discussed, and control variables are identified to minimize this bias. Endogeneity problems are discussed, as are the introduction of province and year fixed effects. Finally, an estimation strategy, taking advantage of variation within provinces and across time to assess the effect of discretion on firm formation, is described.

3.1.1 Main independent variable

In the main specification below, I operationalize discretion in a province as the proportion of provincial revenue deriving from discretionary fees levied by administrative units. Fees levied by SAIC branches, as described above, are of most relevance to private firms. Data on the fees collected directly by SAIC branches, however, is unavailable. One alternative operationalization would be to use the general category of “extrabudgetary revenue” as a proxy for state discretion, as Chen et al. (2011) have done at the provincial level. I use the more specific measure of a province’s “Charges of Administrative and Institutional Units” (a category of budgetary revenue in the *Chinese Statistical Yearbook*)¹⁷ as a percentage of provincial revenue, as a proxy for discretion. These charges are both assigned and established with “de-facto autonomy” by local governments (Choi, 2009, 84; Deng et al, 2010; World Bank, 1994). An example

¹⁷ Though in English translation this category has also been rendered as “Income from Administrative Fees” in some years covered by this data set, in Chinese this category has been consistently labelled as *xingzhen shiyexing shoufei shouru*. I use “Charges of Administrative and Institutional Units” here in the belief that this clarifies the meaning of the category. This category is reported at the province level starting in 1998.

relevant to private firms is fees charged in return for the granting or renewal of business licenses (Choi, 2009).

I take this to be the best available measure of provincial discretion as it is relevant to private enterprises for two reasons. Firstly, there is difficulty in comparing the general category of extrabudgetary revenue data across time, as official measures of extrabudgetary funds changed several times in the mid-1990s (Guo, 2008, 66). Secondly, though a high ratio of extrabudgetary revenue to total provincial revenue might indicate the discretion of state actors, not all types of extrabudgetary revenue imply discretion that is equally concerning to firms. For instance, extrabudgetary revenue in a province may be dominated by penalty receipts collected by the public security bureau. Constructing my proportional measure of discretion using Charges of Administrative and Institutional Units, rather than the alternative category of Penalty Receipts, should go some way toward reducing this potential bias. I sample discretion levels beginning in 1998, the date of the establishment of the measure used here.

I take provinces as my level of analysis for several reasons. There are 31 provinces in China¹⁸, 333 municipality-level units, 2,862 county-level units, and 41,636 town-level units (Xu 2011, 1084). City-level data on Charges of Administrative Units is available in only a small subset of cases. Secondly, Xu argues that “Chinese regions are alike in their economic compositions” (2011, 1100). This is demonstrated by Batisse and Poncet (2004), who found that economic duplication among Chinese provinces is higher than is commonly the case within a nation-state, implying low factor mobility. That

¹⁸ More precisely, there are 22 provinces, five autonomous regions, and four “provincial level municipalities”. The National Bureau of Statistics treats each of these as a province.

protectionism at the provincial level has been a widespread problem is documented by Wedeman (2005) and Fuller (2007), and is supported by the analysis of Li (2010), who found that capital is relatively immobile across Chinese provinces. Liu and Tong (2009) found China's market to be highly segmented along provincial lines. For our purposes, segmented provincial economies and a history of provincial-level protectionism suggest that the province is the appropriate unit of analysis.

Furthermore, in the main specification employed below, I measure changes in Charges of Administrative and Institutional Units as a proportion of provincial revenue, rather than absolute changes in these charges, as indicative of discretion. This follows from the proposed mechanism connecting state discretion and firm formation discussed above. Firms make expected return calculations, and discretionary fees and taxes are both costs that reduce expected returns. In a given year, the burden from fees and taxes are both interpreted in the same units. Firms being forward looking, however, the costs incurred today are also signals about expected future costs. As fees imply discretion, they imply uncertainty about future costs, which reduces expected returns. The proportional measure indicates a province's dependence on discretionary fees as a revenue source, and signals entrepreneurs about expected future costs. A proportional measure captures this reliance, whereas absolute changes in fees do not necessarily do so, depending on changes in other revenue streams. That is, revenue from such fees may be increasing, though at a slower rate than taxation. In sensitivity checks which follow the main results, I estimate the effect of changes in absolute and per capita fee levels on firm formation. Employing this alternative specification does not dramatically alter the results.

3.1.2. Dependent variable

How best to define private enterprises in China is not entirely straightforward (Haggard and Huang, 2008). Huang argues that whether a firm is truly private depends on the assignment of its control rights, i.e., the right to appoint management, dispose of assets, and set the strategic direction of the firm (2008, 17). In their study of the regulation of firm entry throughout the world, Djankov et al (2002) define a private firm as a limited liability company with between 5 and 50 employees after one month of operation. The same measure is used in the World Bank's *Doing Business in China* (2008) and in the "Doing Business" series more generally¹⁹. There are reasons to doubt whether this measure represents truly private enterprises in the Chinese case. Huang notes while 40% of the Chinese private sector was comprised of legal person shareholding firms in 1998, "in China much of the legal-person share capital originates in the state sector, i.e., (State-Owned Enterprises (SOEs)) establishing or holding significant equity stakes in other firms" (2008, 19). Given our focus on the state as a potential expropriator of private enterprises, using this measure would bias our results by including firms which are less subject to discretionary charges and state predation generally than are truly private firms. Defining companies listed on China's two stock exchanges as private is likewise problematic. An OECD study determined that "the state directly or indirectly controls almost 70 percent of every single Chinese listed company" (OECD, 2002, 431).

¹⁹ Reports are available online via www.doingbusiness.org.

I therefore follow Huang (2008) and Zhou (2011) in adopting a narrow definition of the private sector in China. These are private enterprises (*siying qiye*)²⁰ the most conservative definition of firms with private control rights, i.e., the right to appoint management, dispose of assets, and set the strategic direction of the firm (Huang, 2008, 17). That these are truly private firms is perhaps best indicated by their historic political sensitivity. Household enterprises (*getihu*) were officially recognized in the 1982 constitution, and private enterprises only by a 1988 amendment²¹. Whereas non-state firms such as collective enterprises enjoy privileged access to finance from state banks, private enterprises have relied heavily on informal financing (Huang, 2008). As recently as 2011, there were frequent calls in the Chinese press for better access to funding for private enterprises in the aftermath of a government stimulus package that gave preference to the state sector (Wang 2011). Recent work by Zhou (2011) on the effects of deregulation on firm formation also adopted this definition of firms. I operationalize private firms at the provincial level as the number of private enterprises per 1000 provincial residents.

This is a stock measure of firms, which therefore varies by both firm formation and firm failures. I am therefore unable to distinguish failure of a firm to enter operations from a firm's decision to exit operation. Doing so would require access to firm-level data on exit and entry. Though there are clear limitations to the use of aggregate data such as those employed here, all research on firm formation is limited insofar as the decision not

²⁰ Owing to Marx's definition of the point at which private production became exploitative, the Chinese Communist Party defined individual enterprises (*getihu*) as those with seven or fewer employees. These were more politically acceptable than private enterprises (*siying qiye*). However, the "seven employee rule" was implemented differentially across provinces.

²¹ A 1987 speech by Premier Zhao Ziyang, quoted in *Beijing Review*, November 9, 1987, has been taken as de facto recognition of *siying qiye* as a legitimate enterprise form (Young 1989).

to enter the market is theorized, but not observed directly. I return to the limitations of the data on firm formation in the paper's concluding section.

Data for the years 1998-2009 is available from *Chinese Statistical Yearbook*. These years are sampled in order to balance the panel with respect to our independent variable.

Gathering data on 31 provinces over twelve years, I construct 372 province-year observations. All data are obtained from various issues of the *China Statistical Yearbook*, published by China's National Bureau of Statistics. Operational definitions and sources for all variables can be found in Appendix A.²²

3.1.3. Control variables

A naive pooled OLS model of the association between provincial discretion and firm formation is:

$$y_{it} = \beta_0 + \beta_1(\theta_{it}) + \mu_{it} \quad (2)$$

Where: y_{it} is our dependent variable, the number of private enterprises per 1000 residents in province i , year t ; θ_{it} represents discretion in province i , year t ; and μ_{it} is an error with a mean value of zero and a constant variance across different levels of other variables. Our objective is to estimate β_1 , the average effect of a one percent increase in discretion on the number of firms per 1000 residents in Chinese provinces. Estimates derived from a pooled OLS regression may produce biased estimates, however, in that we will mistakenly attribute the influence of omitted variables to discretion. If, for instance, per-capita income levels affect the number of firms in a province and income is not

²² For a defence of the reliability of Chinese official statistics, see Zhou (2011, 862).

randomly distributed with respect to discretion levels, our estimates of discretion will be biased. I therefore control for several observable, time-varying covariates that are likely to affect firm formation. Each is measured at the provincial level.

Income. Per-capita wealth implies high effective demand levels, and richer areas may be more attractive to firms which sell directly to consumers. Using provincial level data from the *China Statistical Yearbook*, I include a control variable for real per capita GDP in constant year 2000 renminbi (RMB).

Wages. The effect of wages on firm formation is somewhat ambiguous for a country as a whole. Low wages can reflect low production costs, and be attractive to private enterprises in, say, the manufacturing sector. To the extent, however, that high wages reflect productive workers, highly skilled workers may be attractive to firms operating in some sectors. Using data from the *China Statistical Yearbook*, I operationalize this control as average wage of staff and workers, in constant year 2000 RMB.

Human Capital. Since educated workers may be more productive, I attempt to control for education levels within each province. Using data from the *China Statistical Yearbook*, I operationalize education as the percentage of the provincial population with at least a junior college education.

Physical infrastructure. Physical infrastructure can generate positive externalities from the point of view of firms, insofar as it reduces transportation costs. Infrastructure spending as a percentage of GDP has been particularly high in China. Following Du et al (2008), and using data from the *China Statistical Yearbook*, I construct a proxy variable

for physical infrastructure, highway density, i.e., the length of highway per square kilometres in a province.

Province and Year Fixed Effects

Despite inclusion of the above controls for observed covariates, potential sources of bias remain. Firstly, there may be unobserved, as yet uncontrolled for provincial characteristics which will affect firm formation. Secondly, as with any research design in which random assignment is impossible, the possibility that one of our regressors is correlated with our error term cannot be ignored. Such endogeneity, if present, would bias OLS estimates of β_1 in equation (2) above. There is reason to believe that this is a danger in the current research. In this section I elaborate on these concerns and make the case that these sources of bias are mitigated by the inclusion of province and year fixed effects.

To see why endogeneity presents a danger to this research design, consider a government department with revenue goals M , and two sources of revenue that might enable them to meet these needs, taxes on private enterprises and fees levied on private enterprises.

Relying heavily on taxes is more attractive if a large number of firms are present within one's jurisdiction. If there are few firms in one's jurisdiction, and little credible prospect of their emergence owing to other factors, the state agent may see little prospect of future revenue through taxation, and thus little to be gained by not expropriating private wealth in the short term. That is, the rate at which the future is discounted by state agents may be shaped by the number of firms in one's jurisdiction. This would reverse the causality of the effect I am trying to assess here.

Though instrumental variable estimation can enable consistent estimates in the face of endogeneity, in the absence of a reliable instrument I rely here on fixed effects estimation, which produces unbiased estimates provided that endogeneity arises from time-invariant factors (Cameron and Trivedi, 2005, 92). This claim finds justification in the literature on China's post-1979 economic reforms. I make this case with respect to several factors.

Though measures of institutional quality, government corruption, government protection of property rights (beyond the discretionary fees measured in this study) differ, Fan et al's marketization index (starting in 1997, multiple years) rank provinces consistently. Led especially by the cities of Shenzhen and Guangzhou, and Guangdong province, the southeast has consistently been on the frontier of reforms which promote the protection of private property rights and government transparency. The Special Economic Zones (SEZs) initiated under Deng Xiaoping in Shenzhen and Zhuhai have served as a model of this process, whereby reforms are first tried out in those areas where expected returns are highest and then, if successful, adopted on a wider basis. This pattern has persisted throughout the 2000s, as evidenced, for example, by the early adoption of Open Government Information (OGI) legislation by Guangzhou, Shenzhen, and Guangdong province. Advantages in institutional quality gained by those provinces on the "governance frontier" have been persistent. This is demonstrated by the largely consistent ranking of provinces on the importance of discretionary fees to government revenue, as documented below. Some authors have gone as far as to speak of the emergence of distinct development models operating among Chinese provinces (Liu et al, 2006; Zheng, 2012).

Some models have been more favourable to private enterprises than others. Taking advantage of a less hostile ideological environment in the wake of Deng Xiaoping's reforms, the provinces on China's eastern and southern coasts made use of their proximity to sources of financing from Honk Kong, Taiwan, and further afield to expand their private sector (Huang, 2008). These advantages to firms in locating in the coastal region may have second-order consequences for provincial governments with respect to the relative attractiveness of charging fees today or waiting in the hope of future gains. In effect, gains from waiting were attractive to potential expropriators in coastal regions. In the interior provinces, however, a different model has emerged in which inability to offer an attractive environment to private enterprises makes current gains from the charging of fees, despite its long term effect on growth, relatively more attractive. The difference in fees as a percent of provincial government revenue between Chongqing and Zhejiang (average values of 13% and 1%, respectively, for the years sampled), is a dramatic illustration of these two models. I therefore include provincial fixed effects to control for intrinsic characteristics affecting firm formation which are not directly observable.

Introducing year fixed effects controls for year-specific policy shocks which have affected private firms on a nationwide basis. For example, Huang (2008) documents a decline in investment by private enterprises in the wake of crackdowns which followed the Tiananmen massacre of 1989. A demonstrable improvement of in the fortunes of private enterprises followed Deng's "Southern tour" of 1992, which was taken as a credible signal that this restrictive period had ended and that the reforms of the past decade would not be rolled back. Policy changes which have an impact on private

enterprises nationwide, beyond those captured by our measure of discretion, can therefore be controlled by introducing dummy variables for each year under study. An example within the time period under study might be China's accession to the World Trade Organization in 2001.

3.2. Estimation methods

The paper's identification strategy takes advantage of within-province variation in discretion over the twelve years of the sample. The characteristics of panel data enable us to measure the association between, on the one hand, province-specific deviations of regressors from their time-averaged values and, on the other, province-specific deviations of our dependent variable from its time-averaged mean (Cameron and Trivedi, 2005, 703). Essentially, I take advantage of within province variation in our regressors over time in order to estimate the average effect of discretion on firm formation. In the model:

$$y_{it} = \beta_0 + \beta_1 \theta_{it} + X_{it}' \beta_2 + \alpha_i + \sigma_t + \mu_{it} \quad (3)$$

y_{it} is our dependent variable, the number of domestic private enterprises per 1000 residents in province i , year t ; θ_{it} represents discretion; X_{it} is a vector of control variables; α_i is a time-invariant province-specific intercept; σ_t is a year-specific intercept common to all provinces, and μ_{it} is a zero mean error term. β_1 is our parameter of

interest, the effect of a one percent increase in discretion on the number of domestic private enterprises per 1000 provincial residents²³.

4. Results

4.1. Summary Statistics

Discretion

Key findings presented here are considerable variation in discretion across provinces, and within provinces over time²⁴. As demonstrated in Table 1, the mean level of discretion for all provinces from 1998 to 2009 was 6.75%. Significant variation, both across provinces and across time, underlies this average. The highest level of discretion was found in Chongqing in 2009, where nearly one fifth of government revenue was from discretionary fees. The lowest level of discretion was found in Zhejiang in 1998, where discretionary charges were nearly absent. Mean discretion levels have varied across time, as indicated in Table 1, which reports yearly cross-sectional provincial means. In 1998, the first year of the sample, mean discretion was 4.05%. The data display a consistent upward trend in discretion until the peak of 2004, when mean discretion reached 8.71%. Thereafter, however, mean discretion levels begin to fall, reaching 6.64% in 2009. This suggests national-level time trends affecting discretion levels, over and above across-province variation which, on the whole, increased over the years sampled. The

²³ A case could be made that lagged values of regressors should be used to estimate discretion's effect on firm formation. Analyses using lagged values has been performed, and results do not differ significantly from those reported below. As taking lagged values requires dropping observations from an already limited dataset, I employ same-year values for all variables.

²⁴ Summary statistics for these and additional covariates are presented in Appendix B.

implementation of *shouzhi liangtiao xian* is one likely contributor to this secular decline. It should be noted, however, that the forces giving rise to higher discretion levels have not abated, and the policy reform should be understood as reducing discretion to a level below that which would have been observed absent the reforms. That average discretion in 2009, while lower than in the 2004 peak, is higher than in 1998 need not cast doubt on the effectiveness of the reforms. Indeed, given the political importance of discretion, the optimal level of discretion from the central government's point of view is not necessarily lower than that observed in 1998. Rather, we can infer from the implementation of the reform that trends in discretion were such that the expenditure of effort on the part of the central government to curtail its exercise through policy reform was seen as justified. It may be that other trends, including the squeezing of provincial budgets by additional reforms centralizing public finance, continued to make the awarding of discretion appealing to provincial governments. *Shouzhi liangtiao xian* merely raised the cost of the exercise of discretion below that which was optimal from the provinces' perspective.

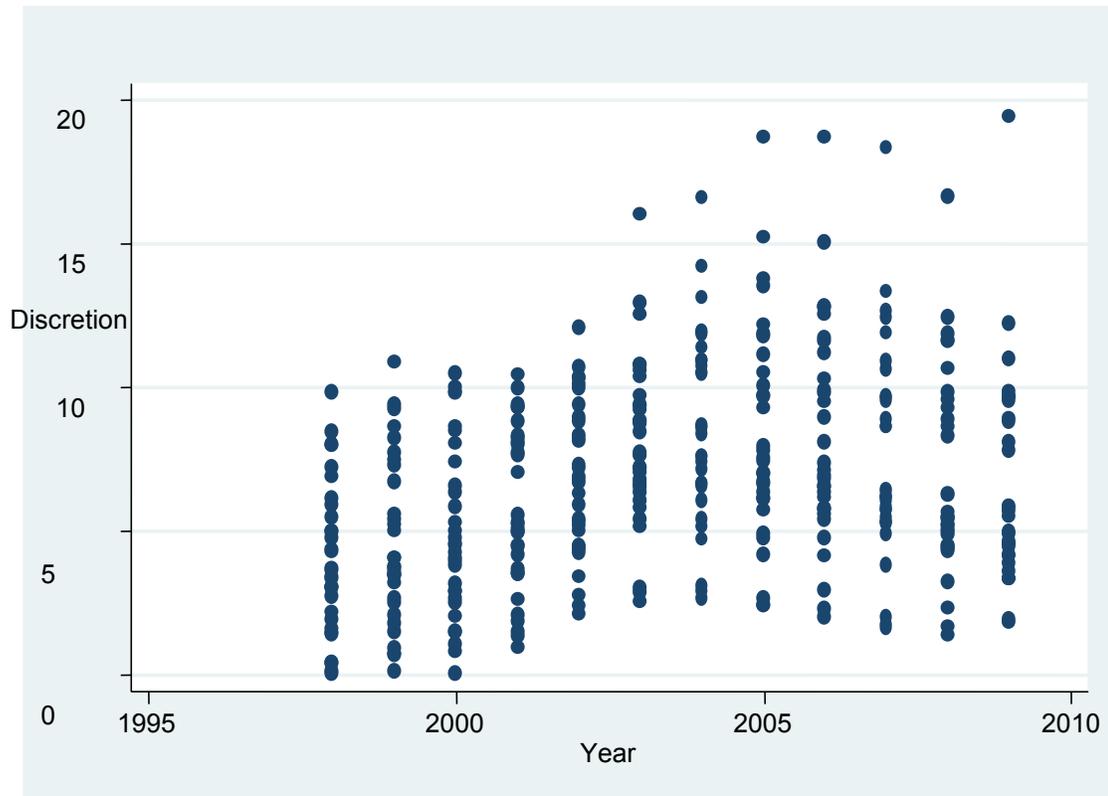
Table 1. Mean Discretion, 1998-2009

Year	Mean	Median	St. dev.	Min.	Max.	Obs.
1998	4.046	3.653	2.620	.045	9.860	31
1999	4.618	3.775	2.888	.110	10.880	31
2000	4.951	4.509	2.976	.063	10.486	31
2001	5.750	5.231	2.836	.954	10.471	31
2002	6.848	6.794	2.677	2.148	12.088	31
2003	8.104	7.752	2.960	2.572	16.052	31
2004	8.713	8.611	3.385	2.662	16.645	31
2005	8.450	7.540	3.860	2.403	18.728	31
2006	8.267	7.129	3.23	2.043	18.732	31
2007	7.617	6.253	3.723	1.661	18.343	31
2008	6.972	5.526	3.566	1.406	16.656	31
2009	6.640	5.557	3.690	1.809	19.468	31
Total	6.748	6.324	3.573	.045	19.468	372

Note: Reported values are annual cross-sectional means for discretion, taking provinces as level of analysis. Discretion is the percentage of annual provincial government revenue deriving from Charges of Administrative Units. Source: *China Statistical Yearbook*, various years.

The passing years are also marked, generally speaking, by increasing cross-sectional variation in discretion levels. This is represented graphically in Figure 1, which plots discretion levels for each province by year, variation clearly being larger in later years.

Figure 1. Time trend in discretion, 1998-2009



Notes: Yearly distribution of provincial discretion levels, as indexed on the vertical axis. Discretion is the percentage of annual provincial government revenue deriving from Charges of Administrative Units. *Source:* *China Statistical Yearbook*, various years.

Table 2 explores across-province variation further, listing provinces according to mean levels of discretion from 1998-2009, from high to low. Mean discretion in Chongqing (13.15%) is nearly seven times higher than mean discretion in Zhejiang (1.93%). Indeed, subtracting Chongqing from our sample reduces the mean from 6.75% to 6.53%. Subtracting Zhejiang increases the mean discretion level to 6.91%. The “Chongqing effect” is particularly strong. Of the ten highest province-year observations of discretion, seven are in Chongqing. The remaining three are in Anhui. Of the ten lowest province-

year observations of discretion, three are in Shanghai, three in Yunnan, two in Zhejiang, and two in Jiangsu.

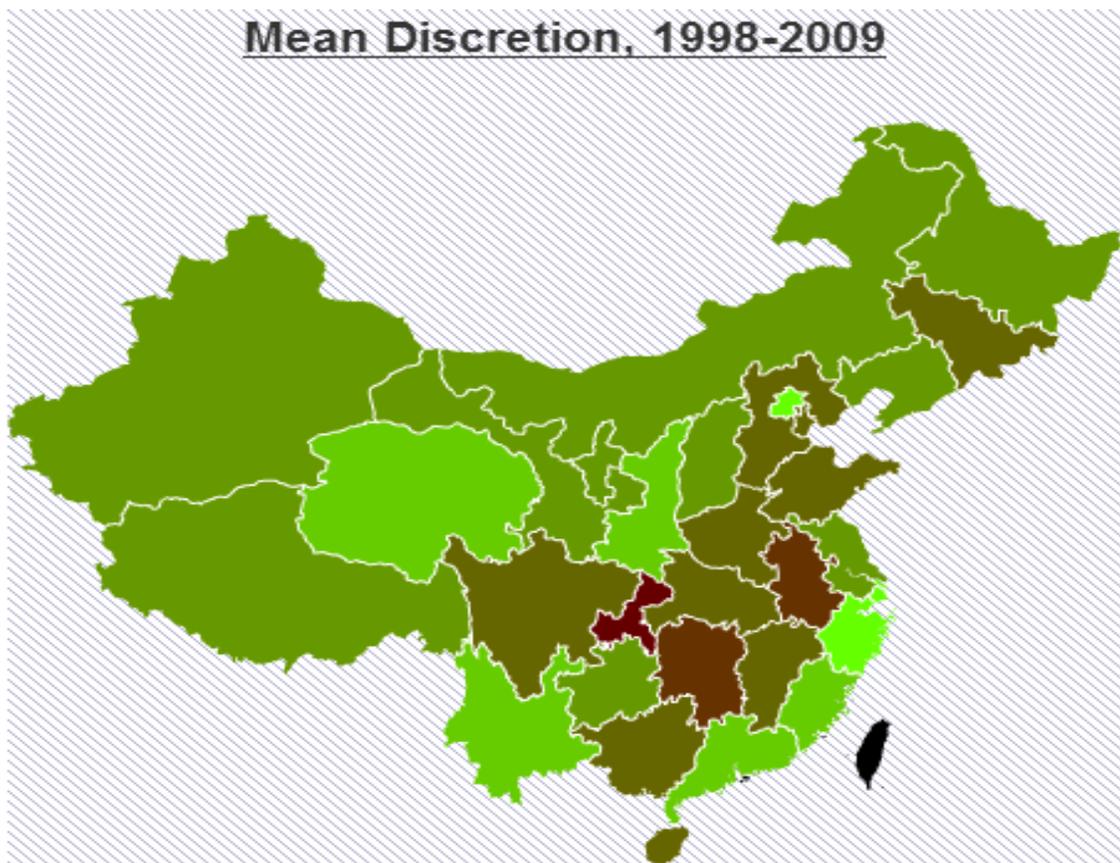
Table 2. Mean discretion by province, 1998-2009

Province	Mean Discretion
Chongqing	13.149
Hunan	11.628
Anhui	11.310
Jiangxi	9.963
Hubei	9.837
Guangxi	9.394
Sichuan	8.697
Jilin	8.484
Henan	8.483
Tianjin	8.424
Shandong	8.232
Hainan	7.730
Hebei	7.601
Inner Mongolia	7.084
Liaoning	7.002
Guizhou	6.483
Tibet	6.431
Ningxia	5.801
Gansu	5.676
Shanxi	5.340
Xinjiang	5.245
Heilongjiang	5.004
Fujian	4.951
Guangdong	4.881
Qinghai	4.763
Shaanxi	4.086
Jiangsu	4.075
Yunnan	3.566
Beijing	2.156
Zhejiang	1.929
Shanghai	1.762

Notes: Reported mean values for discretion by province for the years 1998-2009. Discretion is the percentage of annual provincial government revenue deriving from Charges of Administrative Units. Source: *China Statistical Yearbook*, various years.

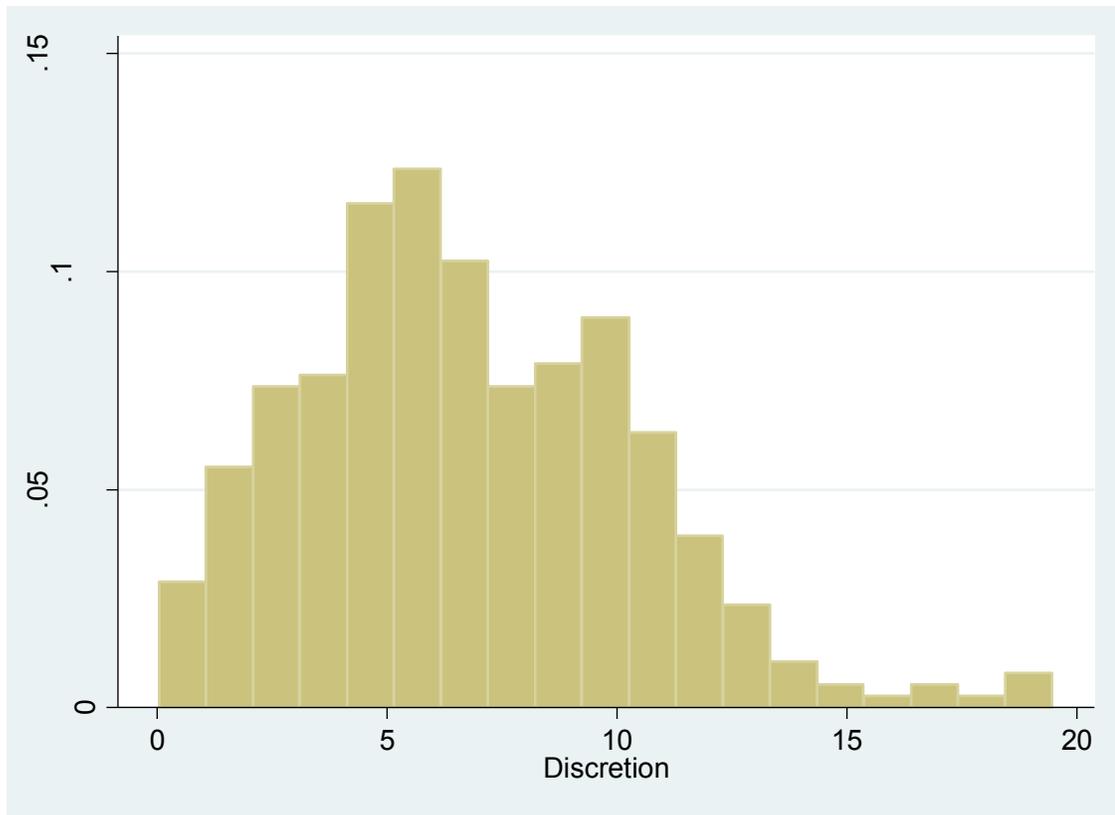
This variation in discretion levels is also represented graphically in Figure 2. In this “heat map”, darker shades represent higher levels of discretion in a province over the years sampled. Figure 3 presents variation in province-year discretion levels for the entire sample in the form of a histogram. The positive skew reflects the presence of outlying provinces, Chongqing prominent among these. Discretion levels of between 5 and 6% are the modal value.

Figure 2. Discretion across Chinese provinces, 1998-2009



Notes: Heat map of mean values of discretion by province from 1998-2009. Lighter shades represent lower mean levels of discretion. Darker shades represent higher mean levels. Discretion is the percentage of provincial revenue deriving from Charges of Administrative Units. The Hong Kong and Macau SARs are omitted, as is Taiwan. Source: *China Statistical Yearbook*, various years.

Figure 3. Histogram of discretion, 1998-2009



Notes: Histogram represents pooled sample of 372 province-year observations. Discretion is the percentage of provincial revenue deriving from Charges of Administrative Units. Source: *China Statistical Yearbook*, various years.

Private Enterprises

From 1998 to 2009, all Chinese provinces saw large increases in the number of private enterprises. As seen in Table 3, taking yearly cross-sectional means of the number of firms per 1000 provincial residents, we find nearly a six-fold increase over the years sampled. That mean levels are consistently higher than median levels partly reflects the attractiveness of Beijing and Shanghai to entrepreneurs. By 2009, Beijing and Shanghai were clear outliers. Indeed, removing Beijing and Shanghai from our 2009 cross section

reduces the sample mean of private enterprises per 1000 residents from 6.176 to 3.322.

Other leaders are Zhejiang, Tianjin, Jiangsu and Guangdong. Laggards in the

development of private enterprises include Guizhou, Tibet, Qinghai, and Hunan. Time

trends for Beijing and Shanghai are graphed in Figure 4, with Liaoning as a reference.

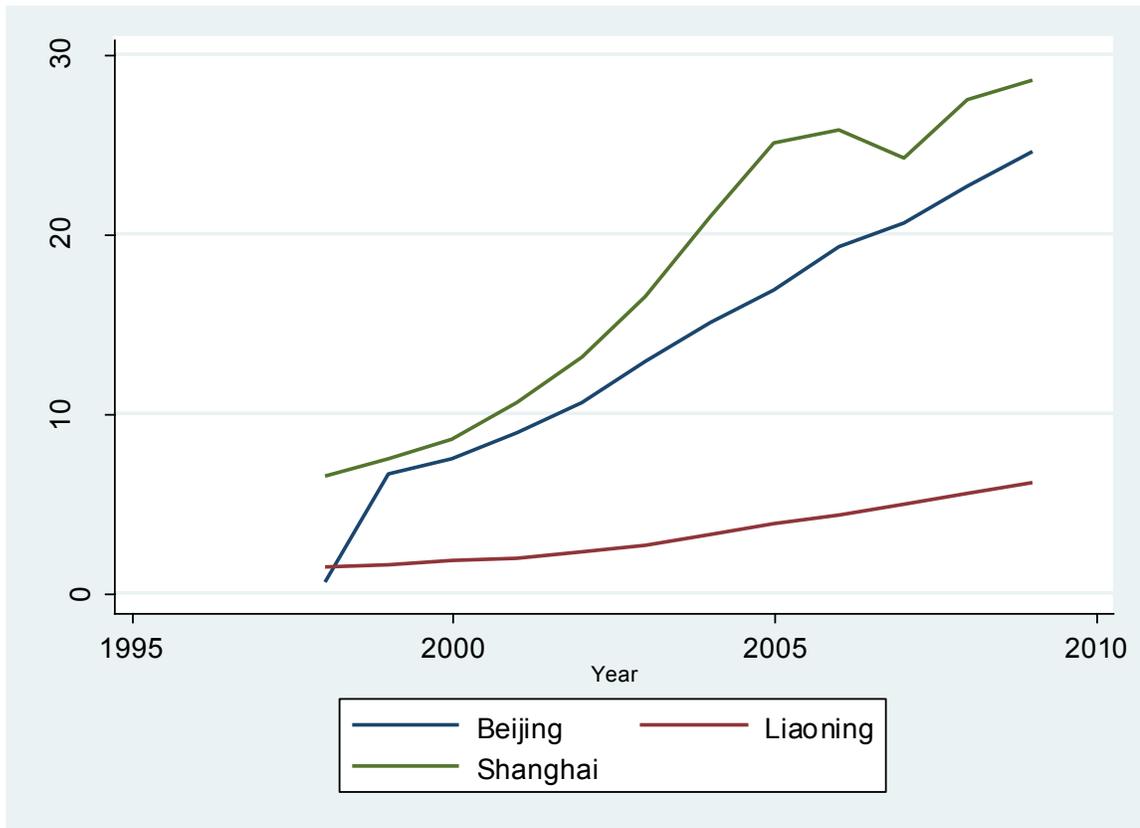
Liaoning's average number of firms over the entire period is closest to the sample mean.

Table 3. Yearly cross-sectional provincial means of private enterprises per 1000 provincial residents, 1998-2009

Year	Mean	Median	St. dev.	Min.	Max.	Obs.
1998	1.119	0.795	1.173	0	6.489	31
1999	1.515	0.903	1.668	0.391	7.463	31
2000	1.707	1.088	1.898	0.381	8.577	31
2001	1.980	1.189	2.303	0.380	10.552	31
2002	2.333	1.426	2.813	0.375	13.135	31
2003	2.866	1.513	3.483	0.721	16.535	31
2004	3.412	1.882	4.273	0.730	20.981	31
2005	3.964	2.209	4.966	1.083	25.079	31
2006	4.427	2.607	5.269	1.060	25.815	31
2007	4.772	2.859	5.160	1.394	24.176	31
2008	5.600	3.584	5.744	1.712	27.464	31
2009	6.176	4.056	6.031	2.020	28.552	31
Total	3.322	1.995	4.328	0	28.552	372

Notes: Reported mean values for yearly provincial cross-sections for the years 1998-2009. Based on the Chinese National Bureau of Statistics' category, private enterprises, operationalized here as the number of private enterprises per 1000 provincial residents. Source: *China Statistical Yearbook*, various years.

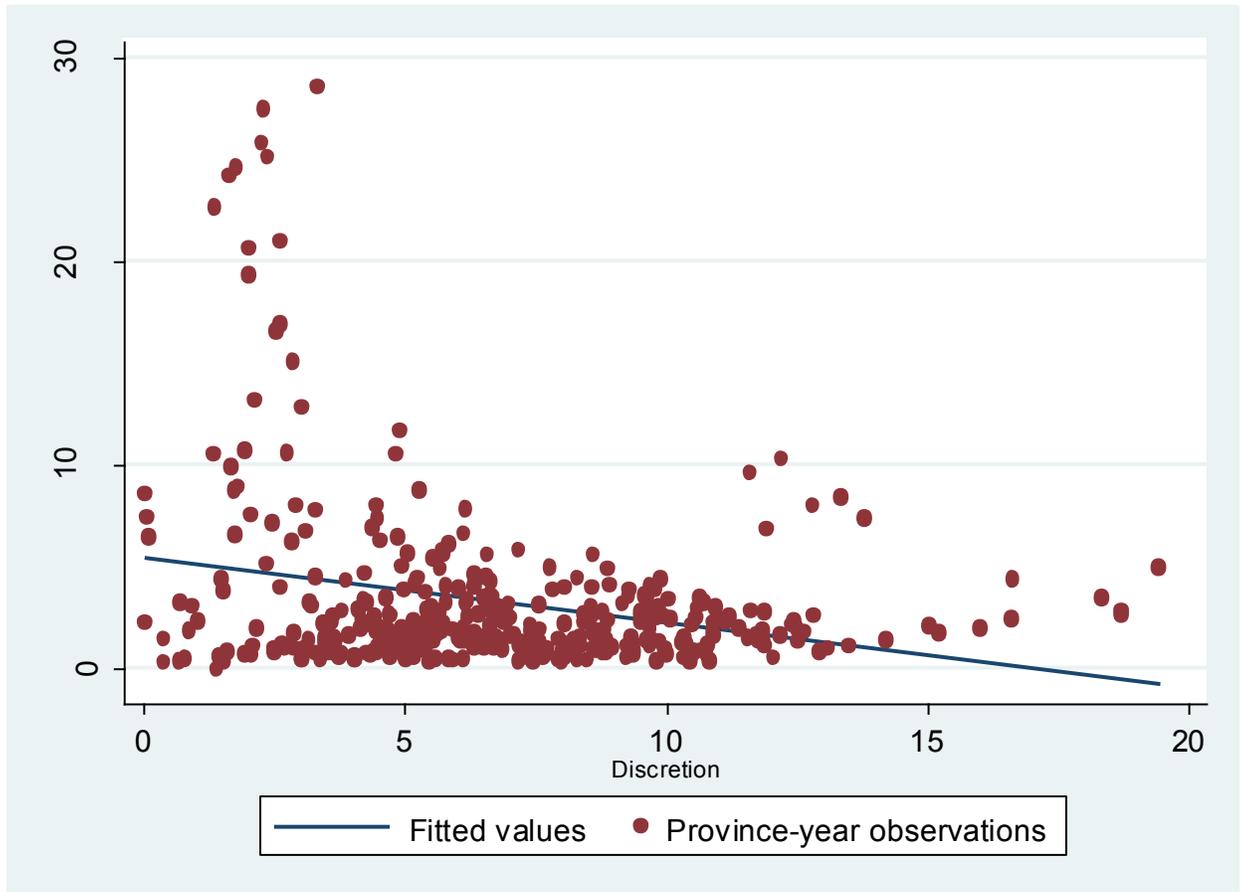
Figure 4. Private Enterprise Growth, Beijing Shanghai and Liaoning, 1998-2009



Notes: Growth in private firms per 1000 provincial residents, as indexed on vertical axis, for years 1998-2009. Source: *China Statistical Yearbook*, various years.

There is a negative association between discretion levels and private enterprises. Figure 5 diagrams a simple scatter plot of private enterprises between 1998 and 2009 against provincial discretion levels over the same years. The vertical axis represents the number of private enterprises per 1000 provincial residents. The horizontal axis represents discretion level for province-year combinations. A negative association between discretion and private enterprises is evident.

Figure 5. Scatter Plot of Discretion and Private Enterprises by Province, 1998-2009



Notes: Scatter Plot of Firms against lagged Discretion for 372 province-year combinations; based on Table 3, column (1). Discretion is the percentage of provincial government revenue derived from Charges of Administrative Units. Source: *China Statistical Yearbook*, various years.

5.2 - Regression Results

5.2.1 – Main Results

Main regression results are reported in Table 4. The non-random assignment of discretion levels across provinces and our relatively small dataset necessitate caution in

the interpretation of these results. One concern, given the limited variation available in small dataset, is multicollinearity. There is a high degree of correlation between several of our covariates, income in particular, and our dependent variable. Multicollinearity can bias estimates of key parameters as covariation between one regressor and the regressand cannot be distinguished from that of second regressor, if the regressors are perfectly correlated. Though the correlation between income and the stock of private enterprises in a jurisdiction is high (0.921), there is not perfect multicollinearity. Bearing the limitations in mind, I take the approach of subjecting our findings to numerous specifications and robustness checks. I identify a consistent downward effect of discretion on private enterprise formation. In all specifications, the effect is both economically and statistically significant. Other covariates are statistically significant predictors of enterprise formation, further indicating that while multicollinearity is present, it does not mask the significance of the regressors included in the model.

Column (1) in Table 4 presents the naïve pooled OLS estimation of the effect of a one percent increase in discretion on the stock of firms in a province. The coefficient of (-0.318) indicates that a one percent increase in discretion is associated with approximately 3 additional private enterprises per 10,000 provincial residents. Real per capita provincial GDP is added to the model in column (2). This reduces the magnitude of the effect of discretion, and dramatically increases the value of r-squared, indicating high collinearity. Controls for wage levels and education levels are added to the model in column (3). The coefficient on discretion (-0.129) is statistically significant at the one percent level, and indicates that a one percent increase in discretion is associated with a reduction in the expected stock of firms of approximately one firm per 10,000 residents.

The economic magnitude of the effect is largely unchanged, and the coefficient remains statistically significant at the one percent level. Columns (4) and (5) check the robustness of these results to outliers. As noted above, Beijing and Shanghai have been particularly attractive to private enterprises. After removing these provinces from the analysis in column (5), the magnitude of the effect of discretion has been reduced somewhat, but still equates to approximately one fewer private enterprise per 10,000 people. In column (5), I test the importance of the “Chongqing effect” noted above. Removing Chongqing from the analysis actually increases the size of the coefficient on discretion, to -0.154. All covariates are statistically significant predictors of firm formation across these specifications. Income, wages, infrastructure quality and education are all positively associated with firm formation. Province and year fixed effects are added in column (6), representing the full model in equation (3) above. The coefficient of (-0.099) indicates that a 1 percent increase in discretion is associated with an additional private enterprise for every 10,000 provincial residents.

Table 4. Determinants of Domestic Private Enterprise Formation in China, 1998-2009:

Regression results

Dependent variable: Private enterprises per 1000 residents

	(1)	(2)	(3)	(4)	(5)	(6)
Discretion	-0.318*** (0.061)	-0.069*** (0.025)	-0.129*** (0.024)	-0.070*** (0.015)	-0.154*** (0.027)	-0.099*** (0.034)
Income	-	4.067*** (0.921)	2.096*** (0.226)	1.774*** (0.150)	2.100*** (0.228)	2.400*** (0.320)
Infrastructure	-	-	1.610*** (0.333)	1.210*** (0.193)	1.553*** (0.344)	1.704*** (0.395)
Education	-	-	0.259*** (0.032)	0.111*** (0.028)	0.261*** (0.032)	0.363*** (0.062)
Wages	-	-	1.011*** (0.200)	0.587*** (0.117)	1.019*** (0.202)	3.842*** (0.062)
Includes fixed effects	No	No	No	No	No	Yes
Includes Beijing and Shanghai	Yes	Yes	Yes	No	Yes	Yes
Includes Chongqing	Yes	Yes	Yes	Yes	No	Yes
Cons	5.470*** (0.464)	-1.346*** (0.241)	-2.114*** (0.251)	-0.828*** (0.150)	-1.985*** (0.265)	-10.693*** (1.077)
R ²	0.075	0.852	0.882	0.842	0.884	0.951
Observations	372	372	372	348	360	372

Note: Data for 31 provinces over the period 1998-2009. Dependent variable in all columns is number of domestic private enterprises per 1000 provincial residents. Main independent variable, discretion, operationalized as share of annual provincial government revenue deriving from Charges of Administrative Units. Details on construction and sources of all variables available in Appendix A. Column (4) omits Beijing and Shanghai from the analysis, reducing the number of observations from 372 to 348. Column (5) omits Chongqing, reducing the number of observations to 360. Standard errors in parentheses. *, **, and *** represent significance at the 10, 5 and 1% level, respectively.

Given the large population of China's provinces, the relationship demonstrated here is also economically significant. Taking the full model in column (6), and using Guangdong, China's most populous province in 2009, as an example, these results suggest that a one percent increase in discretion would translate into a reduction of more than 10,000 firms, as compared with the implied counterfactual. As we saw above,

discretion was highest in Chongqing. Rising discretion levels in Chongqing, from 10% of revenue in 2002 to 19% of revenue in 2009, suggests nearly 3,000 fewer firms, at 2009 population levels, than would be predicted absent changes in discretion. These results support our key hypothesis, that high discretion levels deter firm formation.

5.2.2 Sensitivity checks

In Table 5, I check the robustness of the findings just reported to alternative measures of discretion. In column (1), the discretion is substituted with the absolute level of charges by administrative units. The coefficient of (-2.560) indicates that each 10,000 RMB increase in the total fees collected by a province, the predicted stock of domestic private enterprises is reduced by about 2 ½ firms. In column (2), after introducing fixed effects, the magnitude of this effect is approximately halved. Charges of administrative units, expressed in per capita terms, is our main independent variable in columns (3) and (4). The downward effect of rising discretionary charges on the predicted stock of domestic private enterprises remains, and is statistically significant at the one percent level.

Table 5. Determinants of Firm Formation in China, 1998-2009: Robustness checks

Dependent variable: Private enterprises per 1000 residents

	(1)	(2)	(3)	(4)
Charges (Sum)	-2.560*** (0.319)	-1.200*** (0.462)	-	-
Charges per Person	-	-	-0.818*** (0.116)	-0.465*** (0.123)
Income	2.654*** (0.201)	2.794*** (0.349)	2.724*** (0.206)	2.880*** (0.338)
Infrastructure	2.504*** (0.354)	2.186*** (0.476)	1.482*** (0.310)	1.659*** (0.387)
Education	0.165*** (0.032)	0.340*** (0.064)	0.244*** (0.031)	0.379*** (0.061)
Wages	1.019*** (0.190)	3.409*** (0.452)	1.088*** (0.195)	3.811*** (0.432)
Includes fixed effects	No	Yes	No	Yes
Includes Beijing and Shanghai	Yes	Yes	Yes	Yes
Includes Chongqing	Yes	Yes	Yes	Yes
Cons	-2.866*** (0.032)	-10.865*** (1.083)	-3.141*** (0.203)	-11.893*** (1.118)
R ²	0.892	0.951	0.888	0.952
Observations	372	372	372	372

Note: Data for 31 provinces over the period 1998-2009. Dependent variable in all columns is number of domestic private enterprises per 1000 provincial residents. Main independent variable, discretion, operationalized in columns (1) and (2) as absolute sum of Charges of Administrative Units collected by provincial government. In columns (3) and (4), this variable is expressed in per capita terms. Details on construction and sources of all variables available in Appendix A. Standard errors in parentheses. *, **, and *** represent significance at the 10, 5 and 1% level, respectively.

5.2.3. Additional results

The relative sensitivity of firm formation to the burden of discretionary charges and enterprise taxation are explored in Table 6. Column (1) includes our covariates, and column (2) adds provincial and fixed effects. The effect of higher levels of enterprise

taxation per capita on the predicted stock of firms is positive and statistically significant, while the effect of per capita administrative charges remains negative.

Table 6. Determinants of Domestic Private Enterprise Formation in China, 1998-2009:

Comparison of charges of administrative units and taxation

Dependent variable: Private enterprises per 1000 residents

	(1)	(2)
Charges per Person	-0.394*** (0.092)	-0.175* (0.104)
Taxes per Person	0.582*** (0.036)	0.489*** (0.040)
Income	1.589*** (0.172)	1.659*** (0.297)
Infrastructure	0.980*** (0.239)	1.233*** (0.322)
Education	0.119*** (0.025)	0.292*** (0.051)
Wages	0.498*** (0.154)	1.031** (0.422)
Includes fixed effects	No	Yes
Includes Beijing and Shanghai	Yes	Yes
Includes Chongqing	Yes	Yes
Cons	-1.270*** (0.194)	-6.289*** (1.030)
R^2	0.935	0.967
Observations	372	372

Note: Data for 31 provinces over the period 1998-2009. Dependent variable in all columns is number of domestic private enterprises per 1000 provincial residents. Main independent variable, discretion, operationalized as share of annual provincial government revenue deriving from Charges of Administrative Units, expressed as per capita measure. Taxes per person refers to taxes collected by provincial government from business enterprises, divided by provincial population. Details on construction and sources of all variables available in Appendix A. Standard errors in parentheses. *, **, and *** represent significance at the 10, 5 and 1% level, respectively.

Finally, in Table 7, I estimate the impact of discretion on a different category of firms, household enterprises, (*getihu*). The effect of discretion on these enterprises is sensitive to model specification. In column (1), which includes observed covariates, discretion is, as with private enterprises, associated with reduced enterprise formation. Once fixed effects are added, however, as in column (2), the effect changes sign and its statistical significance disappears. We can thus not extend our conclusions as to the effect of discretion on firm formation to this form of enterprise. Given the limited size of these household enterprises, and their limited fixed capital holdings, they are presumably less attractive to fee collectors.

Table 7. Determinants of Household Enterprise Formation in China, 1998-2009

Dependent variable: Household enterprises		
	(1)	(2)
Discretion	-0.238** (0.114)	0.139 (0.146)
Income	1.659 (1.053)	-1.674 (1.380)
Infrastructure	-4.516*** (1.554)	-1.419 (1.706)
Education	0.168 (0.149)	0.354 (0.268)
Wages	1.096 (0.933)	11.886*** (1.884)
Includes fixed effects	No	Yes
Includes Beijing and Shanghai	Yes	Yes
Includes Chongqing	Yes	Yes
Cons	20.083*** (1.172)	11.547** (4.647)
R^2	0.115	0.687
Observations	372	372

Note: Data for 31 provinces over the period 1998-2009. Dependent variable is household enterprises per 1000 provincial residents. Main independent variable, discretion, operationalized as share of annual

provincial government revenue deriving from Charges of Administrative Units. Details on construction and sources of all variables available in Appendix A. Standard errors in parentheses. *, **, and *** represent significance at the 10, 5 and 1% level, respectively.

6. Conclusion

Despite the potential benefits of economic decentralization detailed in, for instance, Qian and Weingast (1997), this paper finds that government discretion over the establishment and collection of extra-budgetary revenue in the form of registration fees and fines is associated with negative outcomes in terms of the formation of domestic private enterprises. Moreover, despite the claims advanced by Nee and Opper (2012) about the insignificance of Chinese government policy as a driver in the development of China's private economy, I present evidence consistent with the view that entrepreneurs experience government discretion as a binding constraint thorough its uncertainty effects.

In general terms, these findings illustrate the policy relevance of uncertainty-reducing institutions to efforts to increase entrepreneurial activity. As such, they suggest the relevance of insights derived from an NIE perspective to the analysis of the regulation of the private economy in limited access orders. From a policy perspective, the findings suggest that the existing literature on the effect of entry barriers on firm formation and performance, as described above, can benefit from a focus on the discretion of local officials. More generally, the desirability of estimating the impact *de facto*, rather than merely *de jure*, regulatory barriers is seconded by these findings.

High discretion jurisdictions are demonstrated as having fewer domestic private enterprises than jurisdictions with lower discretion levels. Moreover, the finding that firms respond differently to fees than to taxation implies that discretionary charges levied by governments have an effect over and above the present financial burden, which I have attributed to the uncertainty they generate among entrepreneurs. The finding that private enterprises are negatively affected by government discretion, whereas household enterprises are not, will be of interest to scholars of the place of small and medium-sized enterprises in China, and to the debate on the sources of expropriation risk in authoritarian states (Olson, 1993). Indeed, it supports the intuition of Haber, who argued that the risk of expropriation will select for small-scale enterprises which do not rely on judicial enforcement of complex contracts or advanced financial intermediaries: “small firms, artisan workshops, and petty traders” (2006, 700).

Despite these contributions, this research has important limitations. Firstly, the size of our dataset is limited by the inconsistent reporting, prior to 1998, of extra-budgetary revenue collection by Chinese provincial governments. Secondly, the analysis employs aggregate data. As such, the interpretation of our results must be cautious so as to guard against the ecological fallacy. Using aggregate data means that we observe only average effects, and cannot take heterogeneity among firms into account. Strictly speaking, the composition of an existing stock of firms in a province in year t cannot be assumed to be composed of the firms in year $t-1$ plus new firms formed in the intervening year, and it should not be assumed that changes in discretion affect all types of firms equally. That is, beyond changes in the stock of firms in a province, changes in the composition of a province’s stock of firms may itself imply different responses to discretion. In terms of

the behaviour of entrepreneurs, the present data enable us only to observe one choice in the face of discretion levels – the decision to start a firm or not (and even here, we observe only the aggregate effect of these decisions by individual entrepreneurs). Entrepreneurial decisions in the face of uncertainty exist along a continuum, however, much of which is unobserved here. Beyond deterring firm formation, discretion may deter the expansion of firms or their willingness to invest in fixed assets in the belief that there is too much uncertainty to be confident that the firm will later be able to take advantage of the resulting economies of scale. Under conditions of uncertainty, entrepreneurs will have a preference for liquid investment (Feng, 2001, 274), and discretion may thus exert selection effects on the sectors in which firms operate. These effects may be of considerable interest insofar as they have important consequences for provincial economies. Future research on the effects of discretion using firm-level data would be therefore be welcome, as the variation present in micro-data is better able to capture these effects.

More broadly, despite the magnitude of the observed association and its robustness to the inclusion of observed covariates and province and year fixed effects, interpretation must be tempered by the absence of clearly exogenous variation in discretion levels. I have reported here on the adoption, by the Chinese central government, of a policy designed to enhance budgetary transparency among local governments which is expected to reduce the level of fees collected in a province and thus, according to our operationalization, discretion levels. Importantly, this policy, *shouzhi liangtiao xian*, was implemented despite the objections of provincial governments. As such, it is a plausible source of variation in discretion levels over time that has sources beyond those endogenous to

provincial economies. That said, the imperfect implementation of these policies across provinces means that any assertion as to its direct effects on discretion levels must remain speculative. In sum, these limitations suggest that we cannot state categorically that a causal relationship between discretion and firm formation has been identified. Rather, we have demonstrated a robust association that warrants further attention using a larger dataset, firm-level observations, and, should this prove possible, exogenous variation in discretion levels.

In the realm of China studies, the finding that interprovincial variation in discretion levels has increased over time is consistent with the view that Chinese provinces increasingly cohere around two distinct development models, each with their supporters among party elites (Zheng 2012). Provinces on the southern and eastern coasts have moved toward a more regulatory, less discretionary model of dealing with the private sector. Those in the interior, of which Chongqing is an exemplar, have seen increases in the importance of discretion, despite central government attempts to intervene in the fee generation process. Indeed, recent reports in the Chinese press indicate that the practice of charging extralegal fees has hardly abated in some regions. For instance, Chongqing is thought to have charged real estate developers 4.5 billion RMB worth of fines in 2011 (Deng 2012). Given the benefits which accrue to incumbent, state-favoured firms and state officials with the erection of regulatory tollbooths, transitions to more rule-based regulatory regimes are subject to resistance. Though the political economy of the reforms undertaken in the Deng Xiaoping years Chinese has been much studied (Shirk 1993), the sources of this more recent inter-provincial divergence bear further study.

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Appendix A. Operational definitions and sources of key variables

Variables	Definitions	Sources
<i>Private enterprises</i>	Domestic private enterprises per 1000 provincial residents.	China Statistical Yearbook (1999-2010)
<i>Household enterprises</i>	Individual/household enterprises per 1000 provincial population	China Statistical Yearbook (1999-2010)
<i>Discretion</i>	Percent of provincial government revenue deriving from Charges of Administrative Units.	China Statistical Yearbook (1999-2010)
<i>Charges (sum)</i>	Charges of Administrative Units, absolute annual level collected in 10,000 constant year 2000 RMB.	
<i>Charges per person</i>	Charges of Administrative Units as paid to provincial government, 10,000 constant year 2000 RMB, divided by number of persons in province.	China Statistical Yearbook (1999-2010)
<i>Taxes per person</i>	Enterprise income tax as paid to provincial government, 10,000 constant year 2000 RMB, divided by number of persons in province.	China Statistical Yearbook (1999-2010)
<i>Income</i>	Provincial GRP per capita, 10,000 constant year 2000 RMB.	China Statistical Yearbook (1999-2010)
<i>Infrastructure</i>	Physical infrastructure quality, i.e., “length of highway per square kilometre in a region” (Du et al, 2008)	China Statistical Yearbook (1999-2010)
<i>Education</i>	Percentage of provincial population with at least a junior college education.	China Statistical Yearbook (1999-2010)
<i>Wage</i>	Average wage of all staff and workers, 10,000 constant RMB (2000 base year).	China Statistical Yearbook (1999-2010)

Notes: Province is level of analysis for all variables. Using this operationalization of education, data is unavailable for 2001. I therefore report the mean of the previous and following years for 2001. For 2009, the last year sampled, data for wages are drawn from the China Statistical Yearbook category, “Average wage of employed persons in urban units by status of registration and region”, whereas previous in previous years this category did not contain the qualifier “urban”. Past national averages as reported under the 2009 category are nearly identical to those reported under the previous category in 2008. The two categories are therefore considered equivalent for our purposes.

Appendix B. Summary Statistics for Key Variables

Type	Variable	Mean	St. dev.	Min.	Max.	Obs.
<i>Dependent variables</i>	Private enterprises	3.322	4.328	0	28.552	372
	Household enterprises	20.898	7.376	9.208	47.520	372
<i>Independent variables</i>	Discretion	6.748	3.573	0.045	19.468	372
	Charges (sum)	291710.30	333249.20	521.00	1715900.00	372
	Charges per person	73.60	88.67	0.20	819.95	372
	Taxes per person	177393.20	347493.80	11799.62	2935192.00	372
<i>Control variables</i>	Income	12627.48	9664.657	2319.556	56380.44	372
	Infrastructure	0.4823	0.3695	0.018	1.837	372
	Education	5.536	4.281	0.078	31.209	372
	Wages	14350.33	6594.204	5427.419	41639	372

Notes: In 1998, the National Bureau of Statistics reports Tibet having no private enterprises, which accounts for the minimum of the independent variables taking the value of zero.

III. Property rights and investment among Chinese firms: The importance of sunk costs

Abstract

Though numerous studies in the new institutional economics (NIE) literature have demonstrated an association between institutional quality and economic performance, we lack a good understanding of the mechanisms by which particular institutions affect particular economic outcomes. This paper examines data from a World Bank survey of 12,400 Chinese industrial firms and suggests the existence of a “sunk cost mechanism” through which property rights affect firm investment levels. Using two different proxies for sunk costs, I find that new fixed asset investment is more responsive to property rights security among firms with high sunk costs. This finding is robust to the inclusion of firm-level covariates and city fixed effects, and is as predicted by an options model of optimal investment as described by Hirshliefer (1979, 1989), Dixit (1989, 1992) and others. The sunk cost mechanism has implications for the observed clustering of firms across Chinese jurisdictions, as insecure property rights may select for under-specialized firms with a preference for liquid investment.

1. Introduction

Investment is a precondition of economic growth. Yet return on investment by firms is uncertain, and more uncertain conditions, all else equal, are expected to deter new investment. Firms face multiple forms of uncertainty, and in some countries uncertainty about the security of property rights is prominent among these. Institutions which reduce uncertainty in exchange and the cost of enforcing property rights have become recognized, since landmark publications in the field of new institutional economics (NIE) (e.g., North, 1990) and the accumulation of empirical evidence (Acemoglu et al., 2001, 2002; Acemoglu and Johnson, 2005; Hall and Jones, 1999; Knack and Keefer, 1995; Mauro, 1995) as important determinants of economic performance. Cross-country studies of the effect of property rights on investment levels have also demonstrated a positive association (e.g., Svensson, 1998).

This paper contributes to the NIE literature in two dimensions. Firstly, aggregate cross-country studies of investment levels are not robust to subnational and firm level heterogeneity, and recent years have seen the growth of a robust within-country, firm level literature on property rights and investment (e.g., Besley, 1995; Johnson, McMillan and Woodruff, 2002). In the main, however, this literature remains vulnerable to the more general critique of NIE analysis, namely that while it appears that good institutions, broadly construed, matter for economic performance, we lack a clear understanding of the causal mechanisms or channels by which particular institutions matter for particular forms of economic performance (Pande and Udry, 2005; Rodrik, 2006). This paper's main contribution is use micro data to identify a causal mechanism by which perceived property rights security affects firms' new fixed asset investment levels. Examining data

from a comprehensive 2004 World Bank study of 12,400 industrial firms in 120 Chinese cities, I show empirically that a “sunk cost mechanism” links property rights security with investment, such that levels of new fixed asset investment by firms characterized by high sunk costs is systematically more responsive to property rights security than is investment among other firms. This finding is robust to the employment of two proxies for sunk costs. By way of comparison, in the main specification taking research and development spending as a share of sales (R&D intensity) as the proxy for sunk costs, a one percent increase in property rights security as is associated with an additional 11m RMB in new annual investment by firms with an R&D intensity of zero, as opposed to an additional 14m RMB in investment by firms with an R&D intensity of 5%, and an additional 17m RMB for firms with an R&D intensity of 10%. Using the alternative sunk costs proxy of the number of registration licenses required of the firm²⁵, a one percent increase in property rights security is associated with an additional 10.5m RMB of investment for firms of whom only one license is required, and approximately 11.5m, 12.8m , 14.2m and 18m RMB at 5, 10, 15 and 30 required licenses, respectively²⁶. The cross-sectional nature of our data necessitate a cautious interpretation of these results, particularly as the available data do not enable a clear model of the time horizon over which assessments of property rights security matter for investment choices. Nevertheless, the data do contain firm-level measures of property rights security, investment and sunk costs which are clearly within the firm’s choice set. Given these advantages, as well as the robustness of our results to two proxies for sunk costs, the size

²⁵ R&D intensity has been employed as a proxy for sunk costs by Altomonte and Pennings (2008). The number of business registration licenses required of the firm has been employed as a sunk costs proxy by Garcia-Herrero and Martinez Peria (2005). Alternative proxies used in the literature are discussed in section 4.

²⁶ As of January 1, 2005, 1 US Dollar was worth 8.28 Chinese RMB., as per www.xe.com.

of our dataset and its representativeness of industrial activity in a large and diverse developing state, I interpret these results as highly suggestive of a sunk cost channel by which property rights matter for investment. As such, the paper is an important empirical contribution to the elaboration of a NIE perspective on the importance of property rights for enterprise growth.

Our results accord with the predictions of an “options” model of investment under uncertainty as described by Hirshliefer (1979; 1989), Dixit (1989, 1992), Dixit and Pindyk (1994) and List and Haigh (2010), among others. In this view, though standard neoclassical economic models recommend investing until the investment’s present value is equal to its marginal cost, such models fail where a portion of the investment is irreversible (i.e., sunk), uncertainty is reduced over time, and investment can be postponed. The sunk cost mechanism employed here is interpreted as an implication of the irreversibility component, on the assumption that high sunk costs reflect irreversible investments. The intuition of the options model as it applies to firms facing high sunk costs is developed further in the following section.

China remains an interesting case study for assessing the effect of secure property rights on firms’ investment. This is so for at least two reasons, each of which is important from an identification point of view. As in any transition economy, marginal reductions in the uncertainty of property rights may have significant impacts which can be identified empirically. This likely remains the case in China insofar as the property rights protection remains some way from the frontier of complete security. Indeed, the World Bank ranks China 96th on its most recent “Ease of Doing Business” index (World Bank, 2013), behind states including Albania, Ghana and Belarus. The movement toward

recognition of a right to private property in China has been characterized as a “zigzag process” (Milana and Wang, 2013, 389). A few key signposts along this route can be identified. Household enterprises (*getihu*), defined as firms with less than seven employees, were recognized as legitimate by the State Council, China’s highest governing and administrative body, in 1981. All forms of private enterprise were, previously, illegal. Larger private firms (*siying qiye*) were recognized by the State Council in 1988 (Young, 1989). The practice of nevertheless registering de facto private enterprises as less politically sensitive “collective enterprises” existed both prior and subsequent to this reform (Nee and Opper, 2012). The 1997 Party Congress removed formal ideological discrimination against the private sector, identifying it as equally important to China’s economy as the state-owned sector (Haggard and Huang, 2005; Milana and Wang, 2013). However, private property was only granted *de jure* equivalence to public property by the Property Law of 2007 (Zhang, 2008), subsequent to the data investigated here. Moreover, property rights security varies substantially across China. This is borne out in the data presented here, is consistent with the findings of numerous authors, and reflects the decentralization of economic policymaking since the reforms enacted under Deng Xiaoping. Though the economic benefits of this decentralized structure have been much debated (Cai and Treisman, 2006), and much has been made of the importance of jurisdictional competition in preserving de facto access to secure property rights (Montinola, Qian and Weingast, 1995; Qian and Weingast, 1997; Che and Qian, 1998), the variation across jurisdictions has given rise to a fractured regulatory environment Pearson (2007) characterized by discretion on the part of state officials in the enforcement of property rights (Kumar, 1994; Yang, 1994)²⁷. This

²⁷ Variation in “marketization”, of which property rights protection is a component, is also remarked upon

variation enables within-country estimation of the effects of perceived property rights security on investments in new fixed assets, and the firm-level variation present in micro-data enables the robust estimation of channels by which property rights matter to firms.

The paper's main contribution is to demonstrate, using a large, representative survey of Chinese firms, the existence of a sunk cost mechanism by which property rights security affects firms' new investment levels.²⁸ The identification of such channels is important if the NIE is to contribute clear predictions about the effects of particular policy reforms on particular economic outcomes. Though these possibilities are not evaluated empirically here, the sunk cost mechanism is tentatively posited as contributing to an explanation of two additional phenomena of interest to scholars of the Chinese economy. Firstly, this mechanism may contribute to our understanding of the observed concentration of industries by jurisdictions in China in the years prior to the survey data investigated here (He, Wei and Pan, 2007; Long and Zhang, 2012), the drivers of which are thought to require further study (Long and Zhang, 2012, 605). The sunk cost mechanism may exert a selection effect such that jurisdictions with less secure property rights are populated by firms which undertake less irreversible investment. In addition, firms with high sunk costs are in a less favourable bargaining position with government under insecure property rights than are firms with low sunk costs, as high sunk cost firms are locked in to a particular production process while economies of scale develop. If the presence of

by Fan and Wang (2003). Province-level variation in the regulatory burden faced by new firms is documented in the World Bank's *Doing Business in China* (2008).

²⁸Though the term "fixed costs" may be more familiar to non-economists than sunk costs, the latter better captures the concept of irreversible or irrecoverable investment as described in the following section. Fixed costs, as opposed to variable costs in traditional accounting costs, are distinct in that they may be spread out over the life of a business even where they do not vary by sales volume. Sunk costs, however, are upfront irrecoverable costs.

sunk costs leads firms to reduce investment under insecure property rights, over time we should expect the relative frequency of firms with low sunk costs in the population of firms to increase. If high sunk cost firms, under more certain conditions, prosper relative to firms with low sunk costs by developing economies of scale, than we should similarly expect a selection effect whereby, over time, the share of high sunk cost firms in the population of firms increases in jurisdictions which provide secure property rights. In terms of productivity, firms operating under uncertain property rights may avoid incurring sunk costs, thereby forgoing some of the gains in economies of scale, as a form of insurance against expropriation. Under uncertain conditions, firms will be less willing to absorb sunk costs today in hopes, forgoing specialization. In the aggregate, this lack of specialization may affect productivity levels, the stagnation of which during China's period of remarkable growth has been remarked upon by a number of scholars (e.g., Yueh, 2013).

The remainder of this paper is structured as follows. Section 2 provides a theoretical framework and reviews selected literature for understanding the relationship between uncertainty and firms' investment behaviour, and for the finding that firms characterized by high sunk costs are more sensitive to property rights uncertainty. Section 3 describes the data and variables employed in the empirical analysis. Results are presented in Section 4 and Section 5 concludes the paper.

2. Theoretical framework

2.1. Literature review

It is by now development orthodoxy that a flourishing private sector is necessary for national development, and that the broad goal of national economic policy should be to provide an institutional regime such that the population's entrepreneurial energies are channelled into forms of economic activity in which private aims are aligned with social welfare, as in a competitive market system. Entrepreneurs can thus become the engine of economic growth (Audretsch et al, 2006). The ascendancy of this perspective among development economists and development organizations is evidenced by, for example, the World Bank's *Doing Business* reports and *Enterprise Surveys*²⁹. The focus on firms and/or entrepreneurs as key players in development implies a consideration of the choices faced by firms and the uncertain social, economic and policy contexts in which these choices are made. Understanding how firms respond to uncertainty is important for policymakers who would seek to improve national economic performance by removing what firms perceive to be their most binding constraints, where these are amenable to policy reform.

New firm investment is a useful focal point for such analysis. Investment is necessary if firms hope to become large enough to take advantage of economies of scale. To the extent that some portion of investment is irreversible, the investing firm is "locked in" to a production process. This implies the intention of a firm to specialize in the production of particular goods or services, which itself implies increasing productivity, an idea

²⁹ *Doing Business 2014*, the latest such report, includes a comprehensive literature review of academic work relying on the data generated by this series.

dating to Adam Smith (Demsetz, 1988). At the national level, an economy of investing firms is thus a productive and wealth-enhancing system. New investment levels are also a useful barometer of the uncertainty perceived by firms. A new investment amounts to a bet about the future state of the world, and implies a belief that expected returns (that is, future returns discounted by the uncertainty of these returns) on present investment are higher than alternative uses of the invested funds, consumption included. Higher investment levels by profit-maximizing firms implies greater certainty about future conditions, holding return on investment and alternative uses of capital constant.

Numerous forms of uncertainty can be expected to impact firm investment choices. We will denote “market uncertainty” as referring to uncertain future demand for the firm’s products, labour costs, interest rates, exchange rates and the like. Firms are imperfectly informed about the future values of these inputs. Under competitive conditions, market uncertainty is exogenous to individual firms, and does not downwardly bias expected investment returns. That is, the mean expected return on an investment need not be affected by more market uncertainty. This does not imply, however, that firms are indifferent to increases in uncertainty. Hirshliefer (1989) argued that firms have preferences over both expected returns and the variability of these returns. While increasing uncertainty may have zero effect on expected returns, increases in the standard deviation of expected returns are a cost from the perspective of the risk averse firm. For such firms to invest in increasingly uncertain conditions, the compensating mean expected return would need to be higher.

The burden of uncertainty is higher still in the domain we will refer to as “property rights uncertainty” or “institutional uncertainty”. Indeed, the prospect of reaping future returns

presupposes certainty over one's right to the fruits of present investment. Theoretical insights and empirical findings of NIE support the broad assertion that institutional quality is associated with good economic performance at the aggregate level, and have also demonstrated that private investment is sensitive to this constraint. Uncertainty over the security of property rights not only increases the standard deviations of expected returns, but unlike market uncertainty, downwardly biases mean expected returns. Property rights uncertainty is manifested in uncertainty over the enforceability of contracts, and is thus a form of transaction cost in the Northian (1993) sense, preventing mutually beneficial exchanges that would take place were exchange costless.

Policy reforms which reduced property rights uncertainty would seem to have a high marginal value in terms of investment levels. However, in developing and authoritarian states, or what North, Wallis and Weingast (2009) call *limited access orders*, there may be a political cost to increasing property rights security for all private firms. Indeed, far from providing property rights to all on an anonymous basis, most states have historically provided them to elites and barred the majority from access to good institutions. This limits entry by those who might compete with favoured elites who, by virtue of their monopolistic position, accumulate rents which are an incentive to support the regime (North, Wallis and Weingast, 2009). Though all states, other things being equal, would prefer high to low growth, an inclusive property rights regime which would reduce uncertainty and enhance private investment implies the erosion of barriers to entry which maintain rents for elites. The location of the trade-off between these competing objectives of growth and stability reflect the underlying bargaining power of the relevant

constituencies (Knight, 1992; North, 1981, 1993). Policy reform to address property rights uncertainty is therefore a substantial political challenge.

Beyond the challenges of policy reform, empirical research on the association between institutional quality and economic performance faces several challenges, to which the study of firm investment is not immune. As Dani Rodrik cautions, “we know that growth happens when investors feel secure, but we have no idea what specific institutional blue prints will make them feel more secure in a given context” (Rodrik, 2006, 979). The fear that the NIE literature has not provided a complete accounting of the mechanisms by which institutions affect economic performance, firm investment included, also motivates Pande and Udry (2005). I argue here that any attempt to identify mechanisms by which institutions affect investment levels must be cognizant of heterogeneity at the firm level. Given systematic variation across firms by industry, size, ownership status, market conditions and many unobservable characteristics, the instructiveness of empirical studies which restrict themselves to the identification of the aggregate effect of some measure of institutional quality across a sample of firms may be limited. That is, the transportability of findings which identify only aggregate effects to contexts with a different mix of firms is doubtful. Continued progress in the study of firm behaviour may come from attempting to isolate causal pathways by which *some* institutions matter to *some* types of firms in predictable ways, and micro-data such as that employed here can take advantage of firm-level variation to identify these pathways.

To address these limitations, a growing literature examines individual and firm-level data on investment and property rights security, measuring the latter with reference to survey

responses³⁰. For example, Besley (1995) finds that Ghanaian farmers' investment in land improvements is affected by property rights over said land, the latter based on reported rights of property transfer. Johnson, McMillan and Woodruff (2002) survey firms in post-communist Europe and find that profit reinvestment rates are affected by perceived property rights security as determined using survey responses, so much so that after this source of potential uncertainty is accounted for, access to finance has no additional explanatory power. Using a sample of firms from 70 countries, Lin and Wong (2013) find that government intervention in firm decision-making is negatively associated with investment. In related studies in the Chinese context, Cull and Xu (2005) show that Chinese firms reinvest more of their profits when they perceive property rights to be secure.³¹ Hallward-Driemeier, Wallsten and Xu (2006) likewise identify a significant effect of various measures of institutional quality on firm investment, using firm responses to a previous World Bank survey. Along similar lines, Lin, Lin and Song (2010) show that property rights protection is correlated with corporate research and development expenditure, and Lu, Png and Tao (2013) show that property rights have a similar effect on firm productivity.³²

This firm-level variation exploited in these studies enables heterogeneous analysis of causal pathways by which property rights matter for economic performance. The unique

³⁰ For a review of firm-level studies of the effects of the business environment, broadly construed, on development, see Xu (2010).

³¹ Using a previous World Bank survey, these authors rely on responses to the following question, nearly identical to that used in the current analysis to measure perceived property rights security: "On a scale of 0-100%, what is the likelihood that the legal system will uphold your contract and property rights in business disputes?"

³² These authors measure property rights via responses to the following questions: "Among the government officials that your firm regularly interacts with, what is the share that is oriented toward helping rather than hindering firms?"; "What's the likelihood that the legal system will uphold my contract and property rights in business disputes?" The latter is very similar to the question used to measure property rights security in the present analysis.

contribution of this paper is the employment of a large, comprehensive and nationally representative dataset and the identification, on the basis of the firm-level variation therein, of a sunk cost mechanism mediating the effect of property rights on investment.

2.2. *Sunk cost mechanism*

The sunk cost mechanism builds on the insights of Hirshliefer (1965, 1989), Dixit (1989, 1992), Dixit and Pindyck (1994), and List and Haigh (2010). These authors note three conditions which, when present, call into question a simple expected returns model of investment choice. Standard neoclassical models recommend investing until the investment's present expected value is equal to its marginal cost. The conditions mitigating against the value of this decision rule are: *uncertainty* which is partially reduced over time as the firm acquires more information about relevant conditions, the *ability to defer investment*, and that some portion of the investment is *irrecoverable/irreversible*. When present, these conditions indicate a reward for deferring investment, irrespective of expected returns. In aggregate, this implies lower levels of investment in a cross-section of firms where uncertainty rises or irreversibility increases. According to List and Haigh (2010), standard expected return models of investment neglect the opportunity cost of present investment, namely, that "current investment precludes not investing if bad news is observed" (List and Haigh, 2010, 1). Firms may instead adopt an options model in which the proper investment rule is a function of initial payoffs to investment, the irrecoverable portion of the investment, and uncertainty.

Assume that firms face a choice between investing today, at $t = 0$, which carries an initial payoff X , and investing in a future period, $t = 1$. The payoff in this future period, M , is uncertain, and may be either high (H) or low (L), though firms are able to estimate the probability of the high or low payoff, the probability of H being p and the probability of L being $1 - p$. Investment carries an irrecoverable sunk cost, C . One prediction of this model is that as C rises, deferring investment becomes a more attractive option in the presence of uncertainty. The proceeding is an empirical test of this hypothesis.

In this paper, our primary concern is whether levels of C are an important factor in determining the sensitivity of new investment to property rights uncertainty. This is supported by Pattillo, who notes that “uncertainty will have different effects for different types of firms, depending on how sunk their investment expenditures are” (Pattillo, 1998, 530). For estimation purposes, I equate irreversibility with high sunk costs. Dixit and Pyndick (1994) emphasize the pervasiveness of sunk costs in investment projects.

Consider a steel plant which might be thought to have resale value were it to prove a poor investment, as the plant could be sold to another firm in the steel industry. However, if the reconsideration of the plant’s value is driven by a fall in global demand for steel, these conditions make the plant an unattractive asset from the point of view of other firms in the industry who face the same falling demand. Irreversibility is pervasive even where investments are not evidently industry-specific, owing to an information asymmetry between the reselling firm and the prospective buyer. The latter will be unwilling to pay a market price for items that the seller would be unwilling to part with unless they were of low quality, as predicted by the familiar “lemons” problem (Akerlof, 1970).

It is worth emphasizing that firms with high sunk costs face a higher time inconsistency between investment and its return than firms with more liquid investments, as time is required before the benefits of scale production can be enjoyed. Though such firms will therefore be more responsive to uncertainty generally, the deterrent effect may be especially high for such firms where the source of uncertainty is insecure property rights. Firms that have made irreversible investments that are slow to mature are at a disadvantage when bargaining with the state over the terms of their rights to property since, owing to the foregone gains of waiting for economies of scale to develop, threats to relocate the investment to a rival jurisdiction may not be credible (Clague et al., 1997). These dynamics suggest that as C increases, firms are more wary of undertaking investment in jurisdictions where property rights are perceived to be insecure. In effect, then, the impact of a reduction in property rights security on new investment is larger at higher levels of C . This is the sunk cost mechanism.

To my knowledge, this is the first paper to investigate sunk costs as a source of firms' investment responsiveness to property rights. Though well defined in economic theory, how best to measure sunk costs empirically is not entirely clear, and scholars studying sunk costs must resort to proxy variables. Several proxies for sunk costs have been identified. Mata (1996) measures sunk cost with reference to the extent of employment turbulence in an industry on the theory that lower turnover implies a higher likelihood of firm survival, thereby suggesting lower irreversible cost on entering the market. Balasubramanian and Sivadasan (2007) proxy sunk cost with reference to the percentage of capital expenditure in an industry accounted for by the purchase of used capital. Higher shares of used capital indicate that initial capital expenditures are less sunk since,

should the firm fail, it can recover a larger portion of its initial investment. Ghosal (2009) refers both to the share of capital expenditures consisting of used goods and to the existence of rental payments on plants and equipment. As the share of capital that can be rented increases, firms' expenditures are less irreversible, implying lower sunk costs. Garcia-Herrero and Martinez Peria (2005) proxy sunk costs with reference to the minimum capital required to comply with local business regulations, as well as the number of regulatory procedures required to operate in the jurisdiction. The latter follows Djankov et al.'s (2002) work on the tollbooth function of regulations. Higher capital requirements and higher regulatory hurdles are both taken to imply more irrecoverable start-up costs, and thus higher sunk costs. Finally, Altomonte and Pennings (2008), following Davies and Lyons (1996), consider R&D spending as a percentage of the firm's sales as indicative of high levels of sunk costs, since returns on R&D spending are uncertain, and R&D spending is firm-specific and thus of no resale value. This follows the insight of Sutton (1991), who argued that sunk costs are largely driven by the exogenously determined nature of each firm's main activity. There exists, then, no single accepted measure of sunk costs in this literature. While our operationalization of sunk costs here is limited by data availability, I am able to construct two distinct proxies for sunk costs as described in the next section. I follow Altomonte and Pennings (2008) in constructing a measure of R&D intensity and Garcia-Herrero and Martinez Peria (2005) in constructing a measure of the number of business licenses required to operate legally. In both cases, the prediction of our model as to the responsiveness of investments to property rights uncertainty at different levels of sunk costs are borne out.

Though I do not investigate this possibility empirically, this “sunk cost mechanism” by which property rights security affects firm investment has implications for the expected aggregate mix of industrial activity in a jurisdiction. Generally speaking, we should expect the distribution of economic activity across sectors to be affected by property rights security, with insecure property rights selecting for liquid investments and time-consistent contracting. Institutional scholars have frequently observed that the production of some goods is more sensitive to secure property rights than others (Clague et al., 1997). North (1991) noted that transactions of increasing complexity require the overcoming of progressively more challenging information and credibility problems, and the growth of a state that is simultaneously strong enough to enforce property rights and credibly constrained from expropriating private wealth. In a relatively primitive institutional setting, where transacting is costly owing to information asymmetries and the unenforceability of contracts, only face-to-face, in-kind and time-consistent exchange is supportable. These costs can be mitigated under third-party enforcement of property rights by the state, which supports a legal system to enforce contracts. In a modern economy, the production of many goods and services relies on time-inconsistent contracting. Moreover, as the complexity of the goods and services produced increases, the cost of accurately assessing their valuable attributes also increases. Such transaction costs, when sufficiently high, prevent the consummation of mutually beneficial exchange. Institutions can reduce transaction costs and, in the longer run, facilitate the growth of more complex exchange and the creation of greater wealth. States, conceived as organizations with a comparative advantage in the provision of violence, are well placed to reduce transaction costs (North, 1981), and North claimed not only that institutional

quality was the underlying determinant of long run economic performance (North, 1990, 107), but that the state is “an essential precondition for economic growth” (North, 1979, 249). As Bates puts it, “no state, no development” (Bates, 2006, 708).

And yet where states erect barriers to entry so as to generate rents for loyal elites, high entry costs prevent the beneficial effects of competition and impede the allocation of resources to their most productive use. Firms which are not state favoured are discouraged from undertaking investments with a large sunk cost component, and the development of economies of scale is thus foregone. Firms also forego specialization and its associated benefits, as diversification is pursued as a form of insurance against government expropriation. Providing property rights sufficiently secure to encourage specialized investments with high upfront costs that mature over a long period by entirely private firms is a hurdle that most developing states do not achieve. Indeed, some argue that the provision of such rights on an impersonal basis is synonymous with development (North, Wallis and Weingast, 2009; Wallis, 2011). Recent scholarship by economic historians argues that the provision of credible property rights in Britain and Holland had, by the 18th century, induced workers to leave agriculture and resulted in the growth of specialized sectors which were not to be found elsewhere in Europe (van Zanden and van Leeuwen, 2012; Boadberry et al., 2011). Over time, then, we can expect institutional quality to exert a selection effect upon the mix of firms in a jurisdiction. Since investments characterized by high sunk costs are expected to require more secure property rights, insecure property rights will select for small, unspecialized firms which do not rely as heavily on time-inconsistent contracting.

To conclude this section, we have seen that even where, as with market uncertainty, uncertainty has no effect on mean expected returns on investment, risk averse firms will be discouraged from investing by the resulting higher variability of returns. Indeed, wherever uncertainty decreases with time, investment may be delayed and a portion of the investment is irreversible, firms are presented with a reward for deferring investment. Property rights insecurity is perhaps more damaging still, as the mean expected bias of insecure property rights is more clearly downward. Owing in part to the political uses of the uneven provision of property rights, many states struggle to achieve secure property rights sufficient to incentivize investment with a high irreversible component, with unfortunate effects for the development of economies of scale and specialization.

3. Data and estimation strategy

3.1. Sample

Data examined to estimate the effect of property rights certainty on firms' investment choices are from the World Bank's Investment Climate Survey of 12,400 industrial firms in 120 Chinese cities (World Bank, 2006).³³ Administered by China's National Bureau of Statistics, the survey reports data from 2004 and is meant to be broadly representative of industrial activity in China. This is achieved by stratifying the sample of firms by geography, industry type and firm size. Geographically, all provincial capitals were surveyed as well as a number of additional cities reflecting the province's economic size. On average, approximately four cities were selected per province. Within each selected

³³ Data is downloadable from www.enterprisesurveys.org.

city, 100 firms were sampled, with the exception of the provincial-level municipalities of Beijing, Chongqing, Shanghai and Tianjin, in which 200 firms were selected. The sample is also stratified by industry type. In each city, the ten largest industries by sales volume are included. Within each industry, the sample universe of firms is then divided into small, medium and large firms, an equal number of each being randomly selected. The resulting dataset is larger than that used by Hallward-Driemeier, Wallsten and Xu (2006) (1500 firms), Cull and Xu (2005) (2400 firms) and is more representative geographically. Though not as comprehensive as the National Bureau of Statistics' census data on industrial firms employed, for instance, by Liu and Siu (2011), as these authors acknowledge that dataset does not track firm-level fixed asset investment.³⁴

3.2. Investment

The survey asks company accountants to report new fixed asset investment in 2004. This is taken as our main dependent variable, and is reported in units of 1000 RMB. As with any survey, inaccurate or missing responses are a potential concern. As seen in Table 1, removing reported new fixed asset investment for firms in the 98th percentile and above reduces the mean investment level in the survey dramatically, from 32,206,180 RMB to 10,749,060 RMB. This truncated sample also has a lower standard deviation than the full sample. Whether reported investment levels at the high end of the distribution reflect respondent errors or are merely outliers, there is a danger that these values may unduly bias our results, limiting the generalizability of our results to the population of Chinese industrial firms. Table 1 demonstrates that moving from the full to the truncated sample

³⁴ Previous studies using this dataset include: the original World Bank (2006) study of China's investment climate, broadly construed; Wang (2013), who studies the determinants of bribery; Bryson, Forth and Zhou (2013), who study the incidence of CEO incentive contracts among the sampled firms.

does not dramatically affect mean levels of covariates. Summary statistics for the full sample are presented in Panel A of Table 1, and data for the truncated sample of 12,150 firms are presented in Panel B. The mean for our main independent variable, perceived property rights security (discussed in the next sub-section), decreases slightly, from 61.95 to 61.68. Importantly, the two proxies for sunk costs, R&D intensity and Licenses, are largely unchanged in the two samples. Mean R&D intensity decreases from 1.019% to 1.001% when moving to the truncated sample, and Licenses decreases from a mean of 6.481 to 6.425. Means and standard deviations of other covariates are unchanged to two decimal places, with the exception of the natural logarithm of the number of employees in the firm, the mean of which is 5.62 in the full sample and 5.56 in the truncated sample. Given the robustness of the truncated sample to outliers on the investment variable, and the broad equivalence of the two samples on covariates, I therefore limit the analysis below to the outlier-robust, truncated sample of 12,150 firms. In some specifications, I report determinants of investment conditional on new fixed asset investment being positive. An alternative to removing these outliers from our observation would be to take logged values of new fixed asset investment as our dependent variable. Unfortunately, the large number of firms reporting zero new fixed asset investment precludes this approach. In the sub-section addressing the operationalization of sunk costs, I describe an alternative operationalization which deflates investment by a measure of firm size.

Table 1. Descriptive statistics, full and truncated samples

Panel A: <i>Full Sample</i>	Variable	Mean	Std.Dev.	Obs.
	New FAI	32206.18	428705.50	12400
	FAI per log employees	4077.53	57063.94	12400
	Property rights	61.95	38.93	9469
	Number of employees (log)	5.62	1.48	12400
	Firm age (log)	2.13	0.89	12399
	Loan status	0.60	0.49	12398
	SOE	0.09	0.29	12400
	Private firm	0.14	0.34	12400
	Mixed firm	0.50	0.50	12400
	Collective firm	0.07	0.26	12400
	Foreign-invested firm	0.11	0.32	12400
	Hong Kong/Macao/ Taiwan-invested firm	0.08	0.27	12400
	Other ownership	0.01	0.11	12400
	Licenses	6.481	6.820	12400
	R&D intensity	1.019	2.694	12400
Panel B: <i>Truncated Sample</i>	Variable	Mean	Std.Dev.	Obs.
	New FAI	10749.06	30717.36	12150
	FAI per log employees	1507.67	4052.39	12150
	Property rights	61.68	39.01	9253
	Number of employees (log)	5.56	1.43	12150
	Firm age (log)	2.12	0.88	12149
	Loan status	0.59	0.49	12148
	SOE	0.09	0.29	12150
	Private firm	0.14	0.34	12150
	Mixed firm	0.50	0.50	12150
	Collective firm	0.07	0.26	12150
	Foreign-invested firm	0.11	0.31	12150
	Hong Kong/Macao/ Taiwan-invested firm	0.08	0.27	12150
	Other ownership	0.01	0.11	12150
	Licenses	6.425	6.642	12150
	R&D intensity	1.001	2.668	12150

Notes: Firm is unit of analysis for all variables. Panel A presents summary statistics for the full sample of 12,400 firms. Panel B presents summary statistics for the truncated sample of 12,150 firms. New fixed asset investment is measured in 1000RMB. Measures of property rights security are described in section 3.3. Loan status is a dummy taking the value of one when the firm reports having a loan from a bank or other financial institution. Eight dummy variables indicating firm's self-reported ownership status are also included. Where observations are fewer than 12,400 in Panel A or 12,150 in Panel B, nonresponse is indicated. Source: World Bank (2006).

The truncated sample retains a good deal of cross-jurisdictional variation. As shown in Table 2, provincial averages of new firm investment levels range from nearly 25m RMB in Shanghai to less than just shy of 3m RMB in Ningxia, with a sample mean of nearly 11m RMB. Keep in mind that though these averages are reported at the province level for convenience, averages are in fact available for all 120 cities in the survey. Variation among city means exceeds that among the provinces as listed in Table 2.

Table 2. Firm new fixed asset investment by province, truncated sample

Province	Avg.	Std. Dev.	Obs.	Province	Avg.	Std.Dev.	Obs.
Shanghai	25300.22	48795.39	182	Henan	8732.36	26804.88	693
Beijing	22278.27	46128.30	194	Yunnan	8175.167	25073.98	297
Zhejiang	16465.48	36335.83	786	Hunan	7890.71	27506.18	590
Shandong	15346.37	38583.37	872	Anhui	7524.03	26247.30	395
Jiangsu	15341.39	36678.80	866	Gansu	6846.02	24475.50	198
Tianjin	15049.33	35800.68	194	Fujian	6799.88	23339.31	498
Chongqing	14916.5	29924.44	194	Hubei	6795.55	20112.29	692
Guangdong	14470.74	33664.49	883	InrMong	6267.55	25137.49	196
Shaanxi	12061.31	346479.53	297	Guangxi	5856.57	19526.19	296
Jilin	11888.42	33754.88	195	Heilongjiang	5454.12	21967.47	292
Guizhou	10437.59	31290.74	196	Jiangxi	5335.94	19923.42	494
Hebei	10099.24	31704.47	196	Xingjiang	4244.35	25456.61	181
Liaoning	9947.56	28870.88	583	Hainan	3370.94	10574.20	99
Shanxi	9851.99	28229.00	293	Qinghai	3233.63	13009.68	100
Sichuan	9254.75	29915.26	491	Ningxia	2868.73	9247.18	200
				Total	10749.06	30717.36	
							12150

Notes: Unit is 1000RMB. Analysis confined to truncated sample of 12,150 firms. Source: World Bank (2006).

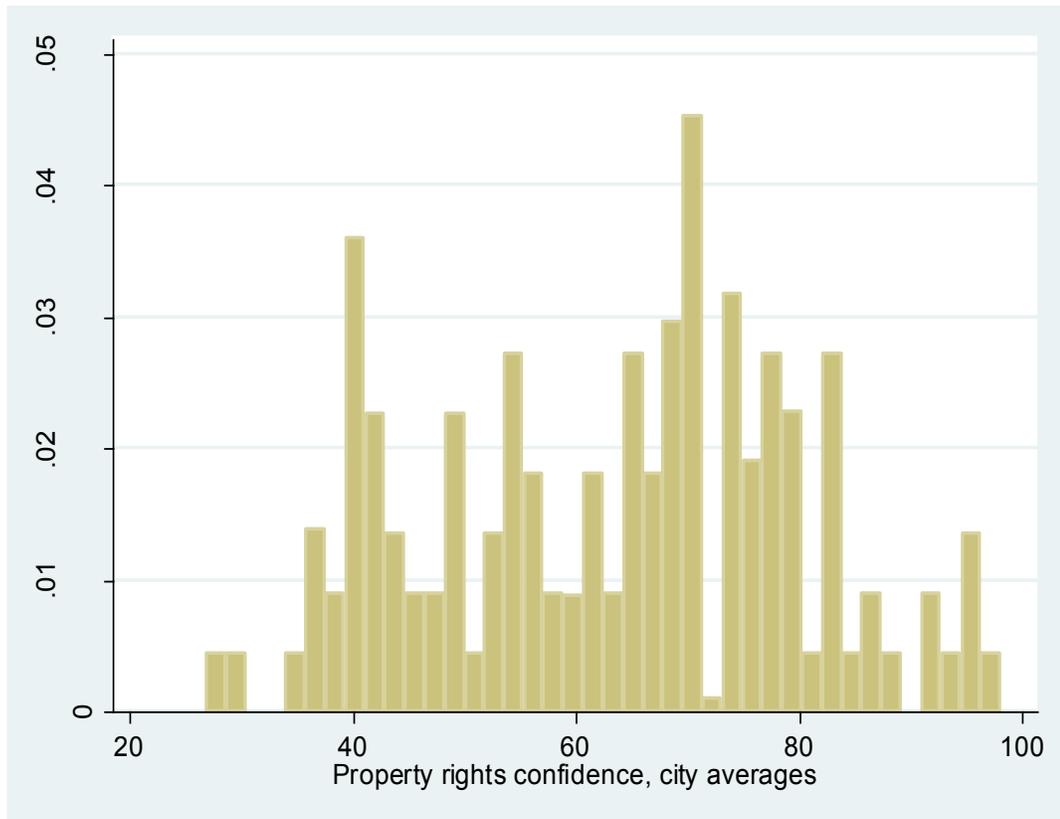
3.3. *Property rights security*

The recent Chinese firm level literature has operationalized property rights using firm responses to survey questions on perceived property rights security. For instance, Lu, Png and Tao (2013) referred to survey responses on the helpfulness of interactions with government, and Lin and Wong (2013) infer from survey responses the degree of government intervention in firm decision making. Lin, Lin and Song (2010) refer to survey responses relating to whether firms sign contracts and firms' estimated likelihood that the terms of contract and property rights will be upheld in business disputes. Though the use of self-reported assessments of property rights security has its limitations, such measures are robust to objection, levelled at attempts to estimate the effect of formal institutions on economic performance, that *de jure* equivalence does not equate to *de facto* equivalence. This is an issue of particular concern in cross-country studies where within country heterogeneity is assumed to be large. It is also desirable, given the mechanism outlined above connecting perceived property rights security with investment decisions, to rely on a measure of property rights security which is clearly within the firm's choice set. I therefore follow the current literature in relying on the firm's subjective valuation of the security of their property rights. The Investment Climate Survey asks company managers the following: "In commercial or other legal disputes, what percent of cases were your company's legal contracts or properties protected (a favorable verdict was passed and enforced)?" The answer is given in percentage terms. I take this response as a measure of certainty about the security of property rights as perceived by the firm, expressed in the variable *property rights*. Note that higher levels of *property rights* imply greater certainty about the security of property rights. The mean

value in the truncated sample is 61.68%, with a standard deviation of 39.01%, while responses range from 0 to 100%. It is hypothesized that *property rights* is positively associated with investment, as firms facing higher levels of uncertainty are rewarded, according to the options model of investment decisions, for deferring new investments³⁵. The distribution of city average perceptions of property rights security is presented graphically in Figure 1. Note that a number of firms fail to report this measure. Baseline estimates of the impact of *property rights* using the truncated sample are therefore limited to 9,253 firms. Non-reporting raises concerns about self-selection, which would limit the representativeness of our findings. I address this danger at the beginning of section 4 by investigating the determinants of reporting a response to this question.

³⁵ Note that using survey responses to the same question from a 2003 survey of Chinese 2400 firms, Lin, Lin and Song (2010) report a mean response of 64% and a standard deviation of 39%. Using slightly different wording in their measure of property rights, Cull and Xu (2005) report 62% and 39%, respectively. The similarity of these results to those presented here should increase our confidence that these datasets are indeed representative of the population of Chinese industrial firms.

Figure 1. Histogram of property rights confidence: City averages



Notes: Distribution of city means of confidence in property rights. Sample includes 120 cities. X-axis indicates average level of confidence in property rights for firms in city. Y-axis represents frequency of given mean confidence level as percent of sample. Source: World Bank (2006).

3.4. *Sunk costs*

Fortunately, the Investment Climate Survey enables the construction of two proxies for sunk costs at the firm level. For my first proxy, following Altomonte and Pennings (2008), I take the firm's R&D costs as a share of its reported sales³⁶. This is computed by

³⁶ The Investment Climate Survey asks each firm's accountant to report R&D expenditure for 2002, 2003, and 2004. They are also asked to report "core business income" over the same years. I take this as my measure of the firm's sales.

dividing the three year sum of R&D spending by the three year sum of sales. This proxy is then interacted with our property rights measure to determine if firms' investment levels are more sensitive to property rights when sunk costs are high. In effect, the inclusion of this interaction term allows the responsiveness of new fixed asset investment to property rights to vary across different levels of sunk costs. A positive coefficient on this interaction term indicates that this relationship is indeed conditioned by the level of sunk costs. As a second proxy, I follow Garcia-Herrero and Martinez Peria (2005) and refer to the sunk costs borne by the firm in satisfying business regulations. The Investment Climate Survey asks firm managers, "How many licenses and registrations (permanent and renewable annually) are required for your company?" A greater number of licenses implies an irrecoverable cost, and thus a positive coefficient on the term interacting this report of the license with property rights security indicates greater responsiveness of investment to property rights among firms with high sunk costs. Neither of these two proxies are taken as definitive operationalizations of sunk costs. That said, taking each in turn as a proxy, the evidence presented below is consistent with the hypothesis that high sunk costs render firms' investment more responsive to the perceived security of property rights.

3.5. Ownership status

The dataset distinguishes firms by several ownership statuses: state-owned enterprises (SOEs), collective enterprises, domestic private enterprises, foreign invested enterprises, firms where ownership resides in Hong Kong, Macau of Taiwan, and various forms of what, following Wang (2013), I identify as "mixed" ownership status. The share of each

firm in the full and truncated samples can be seen in Table 1. Note that the share of firms in each ownership status does not vary from the full to truncated samples. Mixed firms are the most frequently represented, accounting for nearly half the full sample. Private firms are 13.50% of the sample, foreign invested enterprises for 11.28%, state-owned enterprises for 9.05%, Hong Kong/Macao/Taiwan-invested enterprises for 7.99%, collective enterprises for 7.01%, and other ownership statuses account for 1.23% of the sample. Privately owned enterprises may invest more than SOEs as the latter may have objectives beyond profit maximization, including the fulfillment of state employment goals or the deepening of the domestic technology base in furtherance of the aims of the “developmental state” (White and Gray, 1988). Previous research indicates that Chinese state-affiliated firms indeed invest less (Cull and Xu, 2005; Lin and Wong, 2013). Less benignly, decisions in firms controlled by government bureaucrats may be oriented more to the private aims of those bureaucrats than to profit maximization. These distinctions are particularly relevant in China, where SOEs and state-affiliated firms have, even into the contemporary period, received favourable treatment in terms of both capital allocation from state-controlled banks and the security of property rights (Huang, 2008). Huang (2008) also emphasizes the distinction between mixed firms (limited liability corporations, shareholding corporations and share joint-owned units) and domestic private enterprises. The control rights over hiring and major strategic decisions are, in the former, strongly influenced by government. In 2002 the OECD estimated that almost 70% of companies listed on Chinese stock exchanges were directly or indirectly controlled by the state (OECD, 2002). The only firms which Huang identifies as unambiguously private are *siying qiye* (private enterprises) and *getihu* (household

enterprises). In the pre-reform years, each was illegal. *Getihu* were recognized as a legitimate form of association by a 1982 constitutional amendment and *siying qiye* in 1988. In the present study, private encompasses both types.

3.6. Additional controls

Several additional firm and city-level observed covariates are included in the model described below. Two strong predictors of investment at the firm level are the firm's size and age. These are measured here using the logarithms of employment and years in operation, respectively. Firm size may also affect the attractiveness of a firm's assets to potential expropriators within government (Opper, 2004). Access to external finance may also be an important determinant of investment (McMillan and Woodruff, 2002; Cull and Xu, 2005). I therefore include a dummy variable taking the value of 1 when the firm responds affirmatively to the question, "Does your company have loans from banks or other financial institutions?" A series of dummy variables indicating the firm's main industrial activity are also included.³⁷ All specifications include city fixed effects. This is desirable where unobserved city-level characteristics are correlated with variables of interest for firms in a city. For estimation purposes, the inclusion of these fixed effects enables estimation of the parameters of interest using within-city variation, thereby netting out unobserved, city-level factors affecting all firms within the city. They therefore enable us to take full advantage of the geographic breadth of the Investment Climate Survey. Though the survey includes data on city-level GDP and population, these covariates are not included as, this being cross-sectional data, they are subsumed

³⁷ See Appendix B for a list of industries. Regressions omit the industry "agricultural and sideline food processing" to avoid perfect collinearity.

under the city fixed effects. Throughout the empirical analysis, standard errors are clustered at the city level. This is necessary where correlation in the data from firms in the same city is likely. Reported standard errors require independence in the sense that every firm is reporting the same amount of new information. Where there is within-city correlation, this assumption is violated. Clustering standard errors at the city level is a corrective to this problem, and prevents the underestimation of standard errors which, if not addressed, could lead to the misattribution of statistical significance to our results.

4. Empirical results

4.1. Model

The paper's identification strategy exploits variation across Chinese firms in the perceived security of property rights and levels of sunk costs. Both the effect of perceived property rights security on new fixed asset investment and the responsiveness of this effect to the presence of sunk costs are of interest. The full model estimates the latter using the following regression equation:

$$y_{ic} = \beta_1 PR_{ic} + X'_{ic} \beta_2 + \beta_3 S_{ic} + \beta_4 PR * S_{ic} + \sigma_c + \varepsilon_{ic} \quad (1)$$

where y_{ic} is our dependent variable, investment in new fixed assets by firm i in city c .

PR_{ic} represents the firm-level evaluation of property rights security. X'_{ic} represents a vector of firm-level control variables described above. Also subsumed under X'_{ic} are a series of dummy variables indicating ownership status and main industrial activity. σ_c

represents a series of dummy variables indicating the firm's location in one of the 120 cities surveyed. S_{ic} represents a variable indicating the firm's level of sunk costs, according to one of the proxies described above. β_4 , our main coefficient of interest, allows the responsiveness of firms' investment to property rights security to vary by the level of sunk costs. Where R&D intensity and registration licenses are interacted with property rights, a positive coefficient indicates that investment by firms with high sunk costs is more responsive to property rights uncertainty than is investment by firms with lower sunk costs.

4.2. Results

Before turning to the substantive analysis, I first investigate the determinants of firms' reporting of the property rights measure. In the outlier-robust sample, 2897 firms fail to report. There could be a number of reasons for this. It may be, for instance, that newer and smaller firms have not had sufficient experience in the enforcement of contracts to enable them to respond to the question assessing perceived property rights protection. It could also be the case that some firms avoid answering this question owing to its perceived political sensitivity. Were the likelihood of reporting this measure to vary systematically by firm characteristics, this would imply some form of self-selection by firms, which in turn would jeopardize the generalizability of our findings. The results presented below are therefore an important caveat to the generalizability of our findings. Table 3 reports estimates from a logistic regression which takes response to the property rights question as its dependent variable. The strongest predictor of response is firm size,

reported here using natural logs of the number of employees. Neither the firm's age nor its investment levels are statistically significant predictors of reporting the property rights measure. Relative to the baseline of state-owned enterprises, ownership status does appear to be a statistically significant predictor of likelihood of reporting. Indeed, all other categories of firms are less likely to report on the property rights question than are state-owned enterprises. The relevant magnitudes, however, are relatively small. In the full sample, 76% of firms report property rights security, while among private enterprises, who comprise 13.5% of the sample of firms, 71% report. Among firms of "mixed" ownership status, as described above, 79% report. Note also that there is a high degree of correlation between ownership status and firm size. In the full sample, the average number of employees per firm is 949. Among private enterprises, this falls to 379. There are some industry effects as well. Relative to the baseline of "Agricultural and side-line food processing", those in heavy industries are more likely to report property rights security, including timber processing, papermaking, petroleum, pharmaceuticals, mining, metal pressing and special equipment. Firms in these industries are, again, typically large firms.

Table 3. Determinants of reporting property rights security

Dependent variable: Reporting property rights security

	(1)
Employment	0.014*** (0.002)
Firm age	0.003 (0.007)
Other	0.101 (0.233)
Collective enterprise	-0.437*** (0.120)
Private enterprise	-0.370*** (0.104)
HKMCTW	-0.276** (.116)
FIE	-0.185* (0.109)
Mixed ownership	-0.097 (0.090)
Fixed asset investment	0.000 (0.000)
Includes province fixed effects	Yes
Includes industry fixed effects	Yes
R^2	0.109
Observations	12,200

Notes: Standard errors in parentheses. Dependent variable is a dummy variable taking the value of one when firm responds to question measuring property rights security, i.e., “In commercial or other legal disputes, what percent of cases were your company’s legal contracts or properties protected (a favorable verdict was passed and enforced)?” Regression includes province and industry fixed effects. Among the latter, “Agricultural and side-line food processing” is the baseline category. To avoid perfect collinearity, observations for firms in Gansu are dropped from the regression, reducing number of observations to 12,200. *, ** and *** indicate statistical significance at the 10, 5 and 1% levels, respectively. Details on operationalization and sources of all variables available in Appendix A. Source: World Bank (2006).

To the extent that non-reporting is driven by firm size, this may indicate that smaller firms do not have the requisite experience to enable them to answer the property rights question. This is a notable limitation in the generalizability of our results, as the analysis reports more on the experience of larger firms. Fortunately, the insignificance of new

fixed asset investment as a predictor of reporting the property rights question allays fears that reverse causation is driving reporting.

Turning now to the substantive analysis, I first show that perceived property rights security is predictive of new fixed asset investment among the sampled firms. This finding is then subjected to a series of robustness checks before we turn to the paper's main empirical claim, that investment in new fixed assets by firms with high sunk costs is systematically more responsive to perceived property rights security than that of other firms. This is accomplished by estimating β_4 above, which interacts our property rights measure with one of our two sunk cost measures. Two proxies for sunk costs are employed in turn to enhance the robustness of our findings.

Determinants of new fixed assets are investigated in Table 4, absent interaction terms. Column (1) includes all covariates and city fixed effects. Results indicate that a one percent increase in the perceived certainty of property rights is associated with a rise in new fixed asset investment of over 25,000 RMB. This estimate is statistically significant at the 1% level. The effects are economically significant as well. Were perceived property rights security to increase by 10 percent, this implies, assuming a linear relationship, an effect on new fixed asset investment equal to more than a fifth of that associated with the firm's having access to external finance (approximately 1.1m RMB of additional investment as per column (1)). Such increases are within the range of values reported across China. Moving from the sample mean assessment of property rights security, 61.95%, to the average level found in Hangzhou, 98.17%, implies an increase in the representative firm's new fixed asset investment of nearly 942,000 RMB. The covariates included in the analysis in column (1) all display the expected signs. Larger

firms, as measured by the logged number of employees, clearly invest more (an additional 10m RMB for a one percent increase), as do younger firms (just over 1m RMB less for each one percent increase in firm age). As just noted, access to external finance is an important source of additional investment as well. Dummy variables indicated firms' ownership status are included in the regression analysis but omitted here for the sake of brevity. Against the baseline of the ownership status "other", none of these variables are statistically significant predictors of new fixed asset investment. Nevertheless, an interesting finding across all specifications in this study is a clear ordering in the levels of investment undertaken by firms across ownership status. In all cases, foreign invested enterprises invest the most, followed by domestic private enterprises and then by, in order, firms designated "other", "mixed" enterprises, Hong Kong, Taiwan and Macau invested enterprises, state-owned enterprises, and collective enterprises. Our main proxy for sunk costs, R&D intensity, is included in column (1) as a level term. A one percent increase in R&D intensity is associated with nearly 0.5m RMB of additional new fixed asset investment.

Table 4. Determinants of new fixed asset investment

Dependent variable: New fixed asset investment			
	(1)	(2)	(3)
<i>Property rights</i>	25.463*** (7.760)	31.743*** (10.190)	3.520*** (1.015)
<i>Employment (log)</i>	9947.978*** (540.161)	12804.950*** (642.666)	1202.317*** (34.029)
<i>Firm age (log)</i>	-1158.926*** (431.122)	-1863.733*** (557.652)	-175.331*** (55.751)
<i>Loan status</i>	923.931 (563.243)	771.132 (743.841)	241.051*** (71.276)
<i>Sunk cost</i>	440.667*** (133.943)	427.578*** (154.888)	60.832*** (17.348)
Includes city fixed effects	Yes	Yes	Yes
Includes industry dummies	Yes	Yes	Yes
Includes ownership status dummies	Yes	Yes	Yes
R^2	0.243	0.284	0.225
Observations	9,251	6,700	9,251

Notes: Robust standard errors, clustered at city-level, in parentheses. Dependent variable is new fixed asset investment, measured in 1000 RMB. Dummy variable indicating firm's registration status included in regression but not displayed. None of the ownership categories are statistically significantly different from the baseline of "other" in survey. Industry dummies are also included but omitted for convenience. "Sunk cost" is proxied with reference to R&D intensity, as described above. Those firms designated as outliers, as per process described above, removed from original sample of 12,400 firms. Among the 12,150 remaining firms, 2,899 did not respond to the property rights question and are omitted from the analysis, leaving 9,251 firms in column (1). A significant fraction of the full sample (27.33%) undertook no new fixed asset investment in 2004. These firms are removed from the analysis in column (2), as are the outliers as in column (1), for a total of 6,700 firms. In column (3), new fixed asset investment is divided by the log of firm employees. *, ** and *** indicate statistical significance at the 10, 5 and 1% levels, respectively. Details on operationalization and sources of all variables available in Appendix C. Source: World Bank (2006).

The remaining columns of Table 4 report robustness checks on these estimates. In column (2), firms whose new fixed asset investment does not exceed zero are omitted from the analysis. The results largely mirror those in column (1), though the magnitude of the coefficient on perceived property rights protection has increased somewhat

(31.743). In column (3), the dependent variable is deflated to a per employee measure, new fixed asset investment being divided by the log of employment.³⁸ The effect of perceived property rights security on investment remains statistically significant at the one percent level. Note that the magnitude of this effect is not directly comparable to those reported in columns (1) and (2).

³⁸ This operationalization guards against the danger, especially relevant for interpretation of the interaction effect documented in Table 5, that firms with higher sunk costs are simply larger firms that invest more in absolute terms. Were this the case, part of the effect attributed to the sunk cost mechanism would be due simply to the size of the firm. Deflating investment using the per-employee measure guards against this. Logged values of number of employees are used as the denominator in constructing this variable for the same reason as logged values are employed as level terms, namely that reported employment is dominated by outliers.

Table 5. Determinants of new fixed asset investment,
sunk costs-property rights interaction effects

Dependent variable: New fixed asset investment

	(1)	(2)	(3)	(4)
<i>Property rights</i>	20.281* (7.970)	2.820** (1.039)	-10.395 (12.769)	-0.689 (1.693)
<i>Employment (log)</i>	9939.283*** (540.072)	1201.142*** (64.006)	9846.759*** (552.118)	1189.357*** (65.372)
<i>Firm age (log)</i>	-1176.918*** (430.720)	-177.762*** (55.700)	-1187.636*** (426.920)	-178.751*** (55.171)
<i>Loan status</i>	902.756 (558.315)	238.190*** (70.771)	954.536* (557.693)	245.091*** (70.597)
<i>Sunk cost</i>	161.437 (194.638)	23.108 (23.944)	-103.096 (85.549)	-8.756 (11.702)
<i>Sunk cost*prop right</i>	5.125* (3.094)	0.692* (0.410)	5.712*** (1.731)	0.673*** (0.230)
Includes city fixed effects	Yes	Yes	Yes	Yes
Includes industry dummies	Yes	Yes	Yes	Yes
Includes ownership status dummies	Yes	Yes	Yes	Yes
R^2	0.243	0.225	0.245	0.227
Observations	9,251	9,251	9,251	9,251

Notes: Standard errors in parentheses. Dependent variable is new fixed asset investment, measured in 1000 RMB. Dummy variable indicating firm's registration status included in regression but not displayed in table, as are dummy variables indicating firm's industry. All specifications include city fixed effects. Those firms designated as outliers, as per process described above, removed from original sample of 12,400 firms. In column (1), all remaining firms which for which response on property rights question is available are included in sample, for a total of 9,251 firms. In column (1), the dependent variable is new fixed asset investment in units of 1000 RMB. Sunk costs are proxied using R&D intensity. In column (2), per logged employment new fixed asset investment is taken as the dependent variable. R&D intensity remains the proxy for sunk costs. In column (3), the dependent variable reverts to new fixed asset investment in units of 1000 RMB. The proxy for sunk costs in this specification is registration licenses. In column (4), the per logged employee measure of new fixed asset investment is the dependent variable. As in the previous column, sunk costs are proxied using registration licenses. *, ** and *** indicate statistical significance at the 10, 5 and 1% levels, respectively. Details on operationalization and sources of all variables available in Appendix A. Source: World Bank (2006).

We turn now to our primary question of interest, the evaluation of the sunk cost mechanism. It is hypothesized that investment in new fixed assets by firms with high sunk costs is systematically more responsive to perceived property rights security than is investment by firms with low sunk costs. The regression results represented in Table 5 employ our two proxies for sunk costs: R&D intensity and registration licenses. In each case, these are included both as level terms and as an interaction term with property rights security. The interaction term enables the slope expressing the effect of an increase in property rights security on investment to vary between firms with high and low sunk costs. I take this interaction effect as best capturing the responsiveness of investment to property rights among firms with varying levels of sunk costs. Referring to Table 5, R&D intensity is used to proxy sunk costs in column (1), which also includes the same covariates employed in the regressions above, including city fixed effects. The positive coefficient on the interaction term, (5.125), indicates that higher levels of sunk costs are associated with a greater sensitivity of investment to perceived property rights security. The effect in column (1) is statistically significant at the 10% level. All covariates retain the signs found in our initial analysis from Table 4. In column (2), the responsiveness of the per-employee measure of investment is employed as our dependent variable. The coefficient on the interaction term (0.692) remains statistically significant at the 10% level. In column (3), sunk costs are proxied using registration licenses. As hypothesized, the coefficient is positive (5.712) and is statistically significant at the 1% level. Column (4) demonstrates that this effect is robust to the per employee measure of investment, the coefficient (0.673) also being statistically significant at the 1% level. Though no definitive operationalization of sunk costs exists in the literature, by employing two

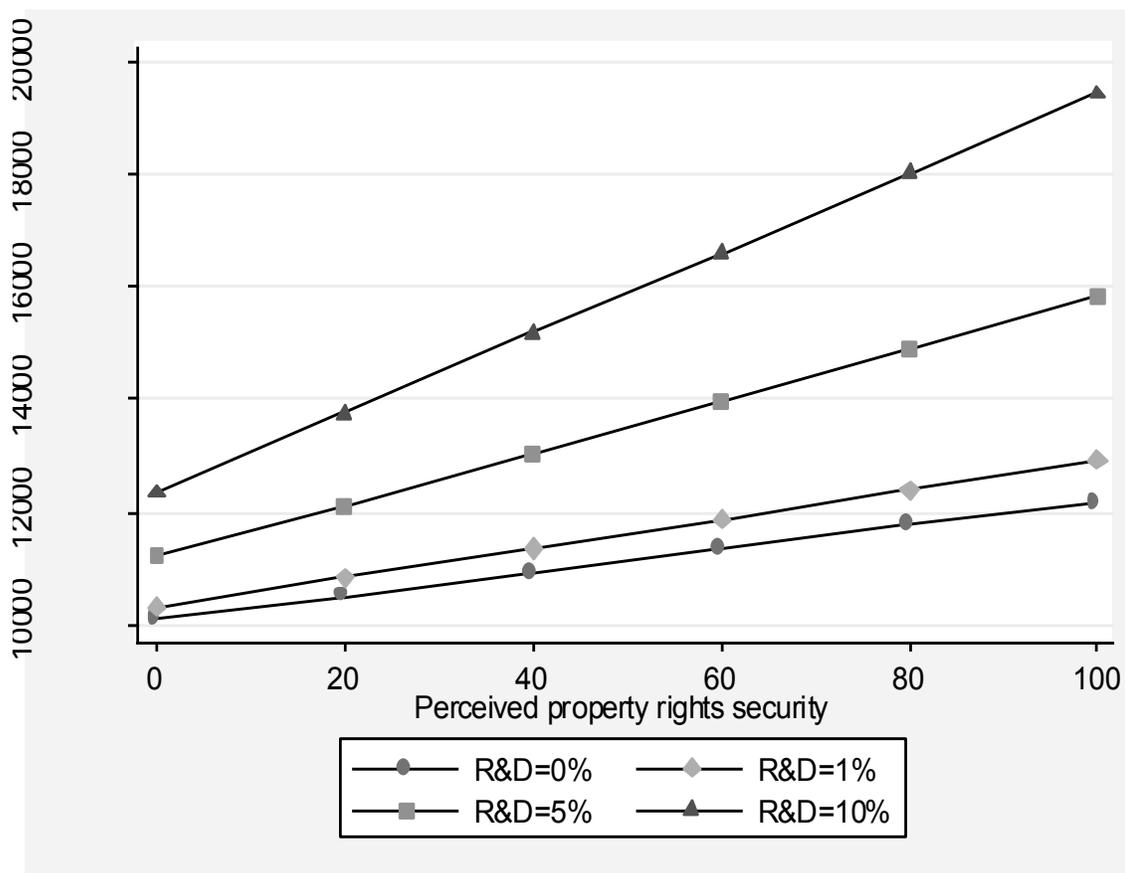
distinct proxies suggested by the literature on sunk costs, the results in Table 5 are highly suggestive of the presence of a sunk costs mechanism. These results are as predicted by an options model of investment, and indicate that the presence of high sunk costs makes firms' investment more sensitive to the perceived security of property rights. In sum, we have found evidence of a channel mediating the effect of property rights security on investment among Chinese industrial firms.

To facilitate interpretation of these results, I now present graphical representations of the responsiveness of investment to property rights at different levels of sunk cost using each of our proxies. Figures 2 and 3 allow the slope of the regression line representing the effect of property rights on investment to vary by levels of sunk costs. Different slopes among the regression lines in each figure indicate the average effect of perceived property rights on investment at different levels of sunk cost, and should be considered graphical representations of the findings presented in Table 5. These figures are complemented by the results presented in Table 6, which reports the marginal effects on increases in perceived property rights on investment at different levels of sunk costs for each of our proxies.

In Figure 2, R&D intensity is employed as a proxy for sunk costs. Three regression lines are presented. The slope of the line labelled "R&D = 0%" indicates the marginal effect of a one percent increase in perceived property rights security on investment when the firm's R&D intensity is 0%. Where R&D intensity reaches 1%, as in the line "R&D=1%", the magnitude of the effect of a one percent rise in property rights security on investment has increased slightly. Once R&D intensity reaches 5%, as represented by the line "R&D= 5%", the effect of perceived property rights on investment increases

dramatically, as indicated by the steeper regression line. When R&D intensity reaches 10%, as in the line “R&D= 10%”, the slope of the regression line is steeper still. These increasing slopes for different levels of R&D intensity indicate that as sunk costs rise, a one percent increase in perceived property rights security has an increasingly large effect on investment levels.

Figure 2. Predictive margins, R&D intensity as proxy for sunk costs



Notes: Figure presents marginal effects of one percent increase in perceived property rights security on new fixed asset investment levels at different levels of sunk costs, proxied by R&D intensity. Increasing slopes of regression lines as R&D intensity increases indicates the increasing sensitivity of investment to property rights at higher levels of sunk costs. For operational definitions and sources for all variables, see Appendix A. Source: World Bank (2006).

The magnitude of these effects can also be gleaned from panel A in Table 6. Among firms for whom R&D intensity is zero, we can see from the first column that a one percent increase in perceived property rights protection is associated with approximately an additional 11m RMB in investment. At an R&D intensity of 1%, as in the second column, the marginal effect is nearly 12m RMB. When R&D intensity rises to 5% in the third column, this marginal effect increases, to over 14m RMB. Finally, when R&D intensity reaches 10%, as in the fourth column, the marginal effect of a one percent increase in property rights security is nearly 17m RMB in additional investment. These figures can be interpreted as identifying the slope of the four regression lines presented in Figure 2.

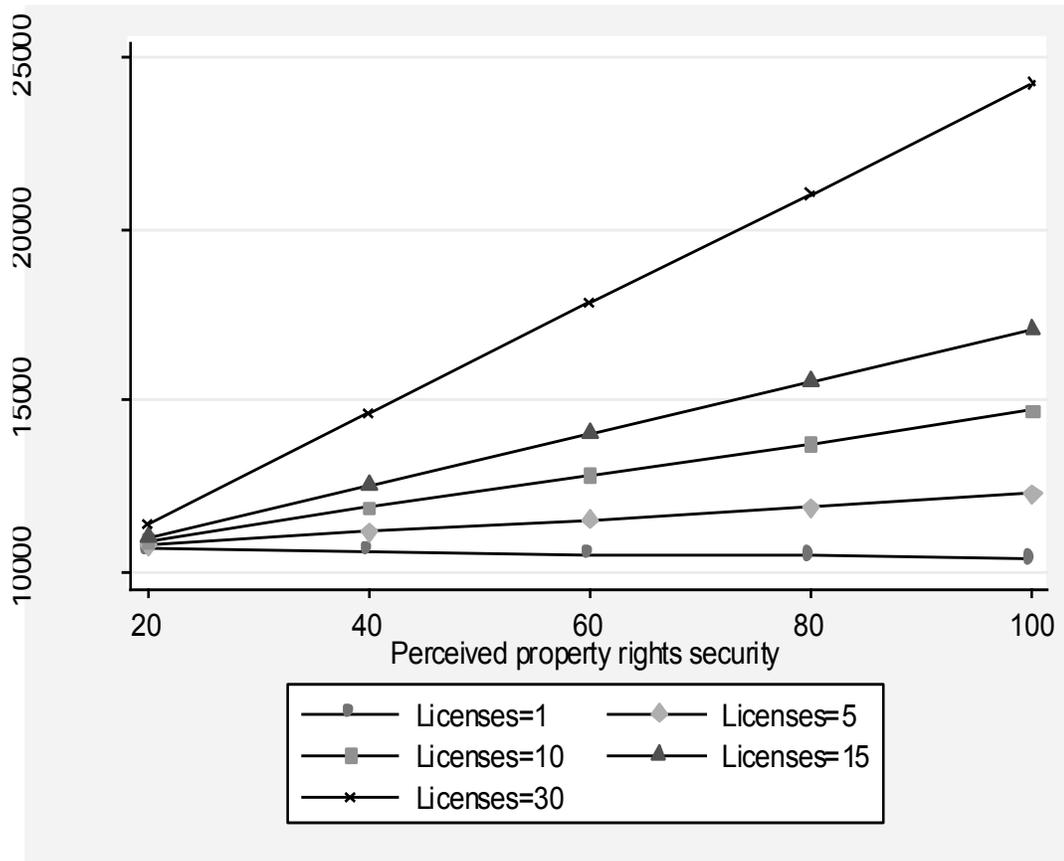
Table 6. Marginal effects of property rights on investment, conditional on sunk costs

	(1)	(2)	(3)	(4)	(5)
Panel A: <i>R&D intensity</i>	R&D=0%	R&D=1%	R&D=5%	R&D=10%	-
Effect of property rights on investment	11374.75	11910.63	14054.17	16733.58	
Panel B: <i>Licenses</i>	1 license	5 licenses	10 licenses	15 licenses	30 licenses
Effect of property rights on investment	10485.72	11535.76	12848.30	14160.85	18098.50

Notes: Table reports marginal effects of one percent increase in perceived property rights security on new fixed asset investments at different levels of sunk costs. R&D intensity, registration licenses and rental status are employed as proxies for sunk costs in panels A, B and C, respectively. Column headings indicate level of proxy at which effect of property rights security on investment is estimated. For operational definitions and sources for all variables, see Appendix A. Source: World Bank (2006).

The graphical presentation of the sunk cost mechanism in Figure 3 relies on the licenses proxy for sunk costs. Sunk costs increase with the number of registration licenses required of the firm, and the positive and statistically significant coefficient on the interaction term in Table 5 indicates that as the number of licenses required of a firm increases, the firm's investment level is more sensitive to its perceived property rights security. In Figure 3, the line "Licenses = 1" indicates the effect of a one percent increase in perceived property rights protection on new fixed asset investment when one license is required of firms. The higher relative steepness of the line "Licenses = 5" indicates that when the number of licenses required of a firm increases from 1 to 5, the median number of licenses required of firms in the sample, the effect of a given increase in property rights security on investment is greater. The direction of this effect is consistent as licenses increases. The lines "Licenses = 10", "Licenses = 15" and "Licenses = 30" (roughly equivalent to the 90th, 95th and 99th percentiles, respectively) demonstrate increasing steepness, indicating the increasing responsiveness of investment to property rights as the number of required licenses increases.

Figure 3. Predictive margins, licenses as proxy for sunk costs



Notes: Figure presents marginal effects of one percent increase in perceived property rights security on new fixed asset investment levels at different levels of sunk costs, proxied by registration licenses required. Increasing slopes of regression lines as the number of required licenses increases indicates the increasing responsiveness of investment to property rights at higher levels of sunk costs. For operational definitions and sources for all variables, see Appendix A. Source: World Bank (2006).

Referring to panel B of Table 6, we can quantify the difference in the slopes of these regression lines at different values of our sunk cost proxy. At the median level of five licenses, for instance, as reported in the second column, a one percent increase in the perceived security of property rights is associated with approximately an additional 11.5m RMB of investment. At ten required licenses, the equivalent figure is nearly 13m RMB, as seen in the third column. Where fifteen and thirty licenses are required, as in

the fourth and fifth columns, a one percent increase in property rights security predicts additional investment of approximately 14m and 18m RMB, respectively. Thus, when employing this proxy for sunk costs, higher sunk costs are clearly predictive of a greater sensitivity of investment to perceived property rights security.

These results indicate that according to two different proxies, a sunk cost mechanism is an important conditioning factor affecting the relationship between property rights security and firm investment among Chinese industrial firms.

5. Discussion

Using firm-level data from a large, comprehensive and nationally representative dataset, this paper supports the literature documenting that Chinese firms' investment behaviour is indeed sensitive to property rights security. The paper's main contribution is to take advantage of the variation in firm-level data to identify heterogeneous pathways by which property rights matter for firm investment. The key channel identified here is the "sunk costs mechanism", which mediates the effect of property rights uncertainty on investment. As levels of sunk costs increases, the responsiveness of a firm's investment to property rights security also increases. Evidence of this effect is robust to two proxies for sunk cost, and the employment of both level measures of new fixed asset investment and a per employee measure. This evidence, interpreted in light of the options model of investment as described by Hirshliefer (1979; 1989), Dixit (1989, 1992), Dixit and Pindyk (1994) and List and Haigh (2010), adds to our understanding of the processes by which institutions affect firm performance.

These contributions should be evaluated in light of a number of caveats. The measure of property rights security employed here has the virtue of being a firm-level assessment. It thus enables a measure of property rights security that is within the firm's information set. Moreover, our two proxies are firm-level measures of sunk costs. Thus we are on firm ground in stating that the sunk cost mechanism operates at the level of the firm in that the assessments and choices implied by the mechanism are all made at the same level of analysis³⁹. More severely, the measure of property rights adopted here does not enable us to shed any light on the time scale on which the sunk cost mechanism operates. The Investment Climate Survey merely asks firms to report the percent of their property that has been protected in cases of commercial and legal disputes. It seems reasonable to assume that this is a retrospective assessment that impacts the assessment of present and future investment opportunities. However, we are unable to determine from the available data whether the firm weights its more recent experience in such disputes more heavily than those in the past. Moreover, the Investment Climate Survey gives firms no explicit guidelines as to the years that ought to be covered by this retrospective assessment. Older firms have longer experience on which to draw, and absent guidelines as to the number of years covered by the question, we can expect that newer firms, according to this measure, are effectively weighting recent experience more heavily than are older firms when assessing property rights security. The data from the Investment Climate Survey also do not enable us to estimate the time scale over which any spot evaluation of property rights security affects current or future investment. It would be preferable to have multiple years of firm-level panel data on this assessment of property rights security

³⁹ In practice, of course, if one were to disaggregate the firm and consider its investment choices as emergent not only from an entrepreneur's assessment of relevant costs and benefits, but from interaction of stakeholders within the firm, this stylized representation is strained.

so that one could investigate the time span over which these assessments, presumably with some lag, affect investment choices. For the purposes of the present research, given that this assessment is made at the time of the survey, I take it as a predictor of the most recent level of new fixed asset investment reported, that is, for the year 2004. In so doing, I am assuming that where present assessments of property rights security deviate from that which would have been reported by past assessments (such as might be made at a point in time that more clearly predates later investment choices), these hypothetical past assessments would be correlated with present assessments. That is, it is assumed the present assessment of property rights security is a good predictor of that which the firm would have made if asked to assess this security in previous years, and thus of assessments which would more clearly predate investment choices.

Though the employment of two proxies for sunk costs increases our confidence in the relevance of the sunk cost mechanism, it would be useful to explore alternative operationalizations, and compare their relative sensitivity of investment to property rights across a wide range of these measures of sunk costs. Data on the share of a firm's fixed capital which is used or rented may be particularly useful.

In considering the generalizability of our results to all of Chinese industry, we should acknowledge the rather obvious point that the firms in this study are all existing firms. Thus, they have, presumably, expectations of a positive return on new investment and positive economic profits. We should not, however, ignore the fact that entrepreneurs considering starting a business make assessments of property rights and sunk costs just as existing firms do. The deterrent effect of insecure property rights on initial firm formation is not observed in this data, but is doubtless nevertheless present. Note also

that the Investment Climate Survey's selection process samples cities from provinces according to their economic size, such that our sample of 12,400 firms draws more heavily from economically larger provinces. If, in the long run, good institutions enable firms to flourish and lead to economic growth, diversity of institutional quality across provinces should lead to provincial economies of diverging economic size. To the degree that the Investment Climate Survey relies more heavily on observations of conditions in economically prosperous regions, our findings may in fact understate the effects of institutional quality on investment across China as a whole if it systematically underweights the experience of firms in regions where institutional quality is particularly lacking. Finally, the non-reporting of property rights security by a significant portion of the firms sampled here is apparently driven by firm size. This implies that though the sample is meant to be representative of all Chinese industrial firms, we must be more confident in the relevance of the sunk cost mechanism to relatively larger firms.

Bearing these caveats in mind, the paper makes an important contribution in the identification, in the form of the sunk cost mechanism, of a channel by which property rights affect firm investment. As such, it contributes to the empirical elaboration of a NIE perspective on institutions and economic performance. The practical implications of this mechanism, though not assessed empirically here, are potentially quite significant. The sunk cost mechanism suggests that institutional quality may exert a selection effect on the type of firms which prosper in a jurisdiction. Since sunk costs borne by firms in expectations of later high returns require time inconsistent contracting while economies of scale mature, insecure property rights will select for firms undertaking liquid and under-specialized investment. Institutional quality may thus be an important determinant

of the clustering of industries across China documented by He, Wei and Pan (2007) and Long and Zhang (2012). Further empirical work investigating this possibility is advocated.

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Appendix A. Operational definitions of key variables

Variables	Definitions
<i>Investment</i>	New fixed asset investment, 1000 RMB
<i>Property rights</i>	Firm response to survey question, “In commercial or other legal disputes, what percent of cases were your company’s legal contracts or properties protected (a favorable verdict was passed and enforced)?”
<i>Firm employment</i>	Logarithmic value of number of employees in firm
<i>Firm age</i>	Logarithmic value of firm age in years
<i>Loan</i>	Dummy variable taking value of 1 when firm reports having loan from financial institution
<i>Mixed</i>	Dummy variable taking value of 1 when firm reports ownership status as either share joint-owned, limited liability corporation or shareholding corporation
<i>SOE</i>	Dummy variable taking value of 1 when firm reports ownership status as state-owned enterprise
<i>Collective</i>	Dummy variable taking value of 1 when firm reports ownership status as collective-owned
<i>Private</i>	Dummy variable taking value of 1 when firm reports ownership status as privately-owned
<i>HKMCTW</i>	Dummy variable taking value of 1 when firm reports ownership status as being invested in by Hong Kong, Macau or Taiwan residents
<i>FIE</i>	Dummy variable taking value of 1 when firm reports being a foreign-invested enterprise
<i>Other</i>	Dummy variable taking value of 1 when firm reports ownership status of “other”
<i>R&D intensity</i>	Three year average of R&D spending as share of firm sales. Expressed as percentage.
<i>Licenses</i>	Number of registration licenses required of the firm to operate legally.

Notes: Firm is level of analysis for all variables. Source for all variables is World Bank (2006).

Appendix B. Distribution of manufacturing industries, full sample

Code	Industry	#	%
13	Agricultural and side-line food processing	969	7.81
14	Food production	243	1.96
15	Beverages production	178	1.44
16	Tobacco production	46	0.37
17	Textiles manufacturing	952	7.68
18	Garment, shoes and caps manufacturing	206	1.66
19	Leather, furs, down and related products	139	1.12
20	Timber processing, bamboo, palm fiber and straw	141	1.14
21	Furniture manufacturing	55	0.44
22	Papermaking and paper products	235	1.90
23	Printing and record medium reproduction	62	0.50
24	Cultural, education and sporting goods	41	0.33
25	Petroleum processing and coking	182	1.47
26	Raw chemical materials and chemical products	1441	11.62
27	Medical and pharmaceutical products	426	3.44
28	Chemical fiber products	47	0.38
29	Rubber products	21	0.17
30	Plastic products	329	2.65
31	Non-metal mineral products	1299	10.48
32	Smelting and pressing of ferrous metals	491	3.96
33	Smelting and pressing of nonferrous metals	345	2.78
34	Metal products	366	2.95
35	General machinery	1077	8.69
36	Equipment for special purposes	486	3.92
37	Transportation equipment	989	7.98
39	Electrical equipment and machinery	864	6.97
40	Electronic and telecommunications equipment	598	4.82
41	Instruments, meters, cultural and office machinery	60	0.48
42	Handicraft products and other machinery	109	0.88
43	Renewable materials processing	3	0.02
Total		12400	100

Notes: Table adapted from World Bank (2006). Industries identified at 2-digit level according to coding of China's National Bureau of Statistics.

IV. Does ICT diffusion increase government responsiveness even in autocracies? An empirical assessment of the political implications of China's internet.

Abstract

Previous studies of the association between citizen access to information and government responsiveness have focused on democratic contexts and rely on electoral mechanisms as explanations for the observed positive relationship. This paper investigates ICT diffusion and government responsiveness in an authoritarian setting, China, by examining data on the composition of government spending. Results indicate that increasing ICT diffusion is associated with a higher proportion of provincial government spending devoted to health and education, and a lower proportion devoted to capital construction. A collective action mechanism is proposed to account for these results.

Keywords: internet, government responsiveness, corruption, authoritarian states, China, collective action

1. Introduction

Since the mid-1990s, the diffusion of information communication technologies (ICTs) in both developed and developing states has been dramatic. In China, for instance, the percentage of individuals with access to the Internet rose from 1.78% in 2000 to 34.3% in 2010. For every 100 citizens in 2000, 6.72 were mobile telephone subscribers. By 2010, this figure had reached 64.04 (International Telecommunications Union, 2013). These developments amount to a substantial reduction in the cost to citizens of obtaining and sharing information. Economists and political scientists have long acknowledged the importance of information to the functioning of markets (Stigler, 1961) and to political behaviour (Downs, 1957), respectively. Reductions in the cost of information should reduce both the cost of search and of collective action, leading to a more efficient allocation of scarce resources, the consummation of more mutually beneficial exchanges, and the achievement of public goods. The implications of these technological developments are perhaps most exciting in the developing world, where previous information revolutions were less impactful. A growing literature has documented the implications of the revolution in information and communication (ICT) technologies for economic and civic life in developing countries. Increased internet access has given rise to labour market intermediaries (Stevenson, 2008) and productivity growth more generally (Ahmad, Schreyer and Wolf, 2004; Vu, 2011). In the case of mobile phones, there is evidence that the reduction in communication costs has improved efficiency in agricultural markets (Aker, 2008; Jensen, 2010), labour markets (Cahuc and Fontaine,

2009) and can improve health outcomes in important ways (Dammert, Galdo and Galdo, 2013).

The diffusion of ICTs may have implications for political behaviour as well. A growing literature, taking advantage of regional variation in citizens' access to information, has found that better informed citizens receive more responsive government, and that technological change, by reducing the cost to citizens of information, is an important driver of more responsive governance.⁴⁰ For instance, Stromberg (2004) considers the importance of a technological shock, the diffusion of radio through the United States, in motivating government responsiveness, measured as the receipt of targeted welfare benefits in the wake of the Great Depression. He finds that counties with higher levels of radio penetration received higher levels of New Deal benefits. Besley and Burgess (2002) demonstrate that Indian state governments are more responsive to need in the wake of natural disasters in those states where citizens have better access to newspapers. Francken et al. (2011) find that radio access predicted the receipt of government relief in the wake of a cyclone in Madagascar, conditional on local damage. Additional research has also demonstrated a link between media access and government accountability (Burns and Himmler, 2011) and the release of information about government and electoral outcomes (Ferraz and Finan, 2008).

Reductions in the cost of sharing information might conceivably be most impactful where traditional media have been state controlled, and where the unauthorized sharing of information is accompanied by personal risk, as in many autocracies. And yet to date, existing research on the effect of information on government responsiveness has largely

⁴⁰ For a review of this literature, see Prat and Stromberg (2013).

been limited to the study of democratic societies. As these studies rely on electoral mechanisms to explain the observed association, it is not evident that these findings are generalizable to non-democratic contexts. Moreover, though the anecdotal evidence reviewed briefly in the next section is suggestive of an association between ICT diffusion and government responsiveness in contemporary China, this possibility has not yet been subjected to a rigorous empirical investigation. This paper thereby represents an important contribution to the debate on the political implications of China's internet. I examine panel data on Chinese provinces covering the years 2001-2010 and find an association between ICT diffusion and government responsiveness that is robust to the inclusion of multiple controls, province and year fixed effects, and a placebo test of the effects of traditional media. The paper proposes a collective action mechanism as the driver of the observed association. In emphasizing the role of ICTs in facilitating collective action, the paper builds on the work of scholars investigating the Arab Spring (Aday et al, 2012; Breuer, Landman and Farquhar, 2012), and Pierskalla and Hollenbach (2013), who show that mobile phone diffusion helps political groups overcome collective action problems, thereby affecting the incidence of civil conflict in Africa. The relevance of a collective action mechanism in the Chinese case is demonstrated by King, Pan and Roberts (2012, 2013), who find that the state's internet censorship focuses on reducing the likelihood of collective action rather than criticism of the government.

The paper also speaks to the debate between camps we might broadly construe as "techno-optimists" and "techno-pessimists". Among the former, Dahl (1989) saw a link between information and transparency which reduced the information asymmetry between elites and the public, increased the ease of public participation and facilitated the

monitoring of government. Other techno-optimists include Huntington (1991), who emphasized the diffusion of television as an important factor explaining the “third wave” of democratization, and Diamond (2010) who argued that even where conditions are not conducive to outright democratization, the internet can be a technology of greater government accountability. The literature on e-government in particular is also promising. Defined by Lau et al (2008, 89) as “the process of connecting citizens digitally to their government in order that they might access information and services offered by government agencies,” e-government both reduces the cost of information about government from the point of view of citizens, and to the extent that citizen-government interaction happens online, reduces officials’ opportunity to utilize their discretion. Some promising findings already exist.⁴¹ For instance, Andersen and Rand (2005), Andersen (2009) and Garcia-Murillo and Ortega (2010) examine cross-national data and find significant returns to investment in e-government in terms of the reduction of corruption. This has been supported by case studies as well (Chawla and Bhatnagar, 2004; Kim et al, 2009).

Some, however, have voiced skepticism as to the effects of reduced information costs and greater government transparency in autocracies (Malesky, Schuler and Tran, 2012).

Indeed, some have argued that the internet may “undermine the quality of political deliberation and the nature of social interaction” (Zheng, 2007, 86). Sunstein (2001) feared that the internet would lead to political fragmentation which could make political mobilization in the public interest more difficult, and empirical findings lend some support to the thesis that new, “democratizing” technologies may in fact reduce social

⁴¹ See Ojha et al (2008) for a comprehensive review.

capital and trust, undermining their positive effects (Putnam, 1995). Olken (2009), for instance, found that Indonesian districts with better access to television and radio signals reported lower levels of trust and participation in social organizations.

Estimation of the effects of ICT diffusion on government responsiveness in the present study is facilitated through the employment of panel data covering the 2001-2010 period, during which variation in ICT access across time and across Chinese provinces is significant. Following Mauro (1998) and Tanzi and Davoodi (1998), I measure responsiveness with reference to the composition of government spending. Theory suggests that state officials are not indifferent to this composition, as some forms of spending facilitate the capture of rents more easily than others (Rose-Ackerman, 1999). Empirical results indicate that increasing ICT diffusion is associated with a higher proportion of provincial government spending devoted to health and education, and a lower portion devoted to capital construction. In the full model with the inclusion of multiple controls and province and year fixed effects, a ten percent increase in internet diffusion is associated with a 3.6 percent reduction in the share of provincial government spending devoted to capital construction, nearly a one percent rise in the share of government spending devoted to education, and nearly a one percent rise in the share of government spending devoted to health. For a ten percent increase in mobile phone diffusion, the corresponding figures are -2.3 percent, 0.57 percent and 0.63 percent. A placebo test using access to traditional print media, in contrast, finds no effect. While, given the non-randomness of ICT diffusion, these results do not enable us to make definitive causal claims about the effect of ICT diffusion on government responsiveness,

I argue that the robustness of the evidence presented here is highly suggestive of a causal relationship.

In a supplemental analysis, I investigate whether, after controlling for ICT diffusion, the adoption by a number of Chinese cities and provinces of open government information (OGI) policies has any effect on the composition of government spending. I find no consistent effect. This suggests one, and perhaps several, of the following: the technology on which such platforms depend is the driver of observed effects on responsiveness, a possibility that should be investigated in studies of the benefits of e-government; Chinese government websites may be particularly ineffective and may not functionally approach the level of desired transparency; the effects of access to information on government responsiveness are driven more by the collective action channel, described below, than by the direct effect of enabling citizens to be better informed about government.

The remainder of this paper is structured as follows. Section 2 reviews the empirical literature on citizen access to information and government responsiveness and associated mechanisms, and reviews optimistic and pessimistic accounts of the transportability of these mechanisms to authoritarian China. It also explains the logic whereby the composition of government spending is a good measure of government responsiveness, and of Chinese public expenditure on health, education and capital construction. Section 3 describes a mechanism whereby ICT diffusion is predictive of enhanced government responsiveness in China. The paper's identification strategy is presented in section 4, and results follow in section 5. Section 6 concludes the paper with a discussion of caveats to and implications of our findings.

2. Information and responsiveness in contemporary China.

2.1. ICTs in China

Whether the oft-observed association between information and responsiveness exists in non-democratic contexts is an interesting question. In the case of China, affirmative claims face the challenge that the causal pathway by which informed citizens are typically thought to incentivize government responsiveness, namely elections, are almost entirely absent in China.⁴² Moreover, those seeking to share and obtain politically sensitive information in China face costs not borne by citizens of liberal democratic societies. The content of the information received, at least via traditional media, is also different. China's official news agencies "stress their missions (to)... correct opinion" (Lei, 2011, 294), and to control reporting, content creation and news dissemination (Hung, 2013, 43). Television remains especially tightly controlled, and the dissemination of political propaganda remains an important function of the industry (Miao, 2011). In 2011, the central government urged regional television stations to cease airing entertainment programming thought to have a corrupting influence. News and educational programming were suggested as appropriate substitutes⁴³. In 2012, Chongqing replaced primetime dramatic programming with "red culture" programs (Lau, 2012).

Some have suggested that ICT diffusion presents a radical departure for China, opening a new, anti-hegemonic social space which is less easily controlled (Tai, 2006; Tong and

⁴² The caveat reflects the existence, since the late 1980s, of village-level elections in parts of China (Luo et al, 2007; O'Brien and Li, 2000; Morduch and Sicular, 2000).

⁴³ Xinhua, "Xian Yu Ling" (Order to limit entertainment programming), http://news.xinhuanet.com/ent/2011-10/25/c_122193826.htm

Lei, 2012; Lei, 2011, 297). China's censorship of the internet is well-documented, and government policy has played an important role in the development of internet technology within the country. The benefits of internet connectivity were recognized at the highest levels of the leadership. Speaking in 2000, Jiang Zemin emphasized that China, "should deeply recognize the tremendous power of information technology and vigorously promote its development" (in Tai, 2006, 120). The nation's first email was sent via the China Academic Network in 1987, and several data networks were constructed in the following decade (Harwit, 2004). Scholars have noted the importance of existing telecom infrastructure for ICT diffusion in China (Zhao, 2002), and the current digital divide between the developed coastal provinces and the relatively impoverished interior is in part a legacy of gaps in telecommunication infrastructure and high connection fees which persisted in inland provinces until the mid-1990s. Such fees were an important revenue source for the Ministry of Posts and Telecommunications (Harwit, 2004). The relative burden of fees across regions were important in the early years of internet diffusion as well, and income levels have been a consistently strong predictor of diffusion rates across provinces. By June of 1995, commercial service was available in Beijing, Shanghai, Guangdong, Liaoning and Zhejiang. Government policy enacted in March 1999 forced the reduction of access fees. From a low user base, penetration in the poorer areas increased dramatically between 1998 and 2002 (Harwit, 2004, 1022).

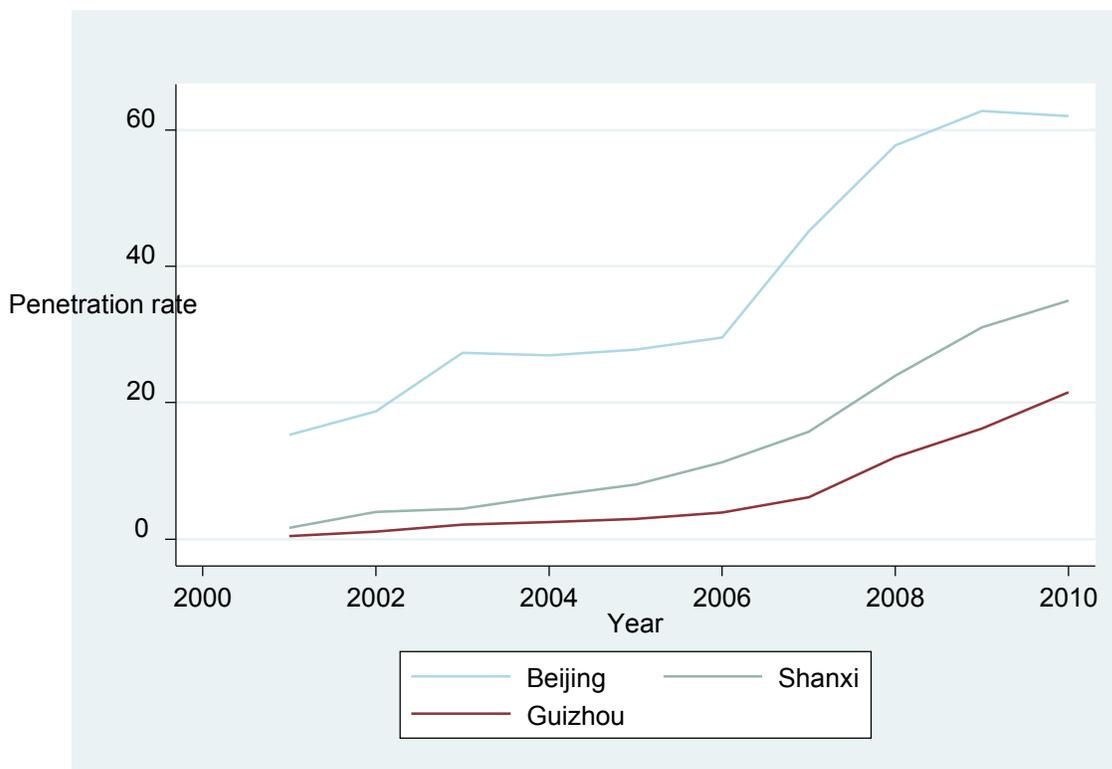
By the end of 2010, the quasi-governmental China Internet Network Information Center (CNNIC) estimated that China had 457 million "net citizens", and an overall internet penetration rate of 34.3% (CNNIC, 2011, 17). This number has grown dramatically since

2001, the first year covered by the data used here, when internet penetration in China was estimated at 2.6% (International Telecommunications Union). CNNIC surveys have also described the population of internet users in China. As of 2010, they are 55.8% male, and more likely than not to be under the age of 30. Interestingly, income is not a strong predictor of internet use in China, and the percentage of internet users who are poor has been growing (CNNIC, 2011, 27). That said, there remains a significant urban-rural divide in internet use. Whereas just over half of China's people live in urban areas, 72.7% of internet users live in urban areas (ibid, 29). By the end of 2010, the CNNIC estimated that there were over 600 million web pages in China, nearly half of which were catalogued as "dynamic".

That said, the consensus among scholars of China's internet is that a clear digital divide remains between coastal and inland areas, the primary determinants of which are income, education, geography and population density, and existing telecom infrastructure (Wang, 2002; Zhao, 2002; Harwit, 2004). Consistent reporting of measures of internet and mobile phone diffusion are available via China's National Bureau of Statistics at the province level beginning in 2001. In this first year of our dataset, just over 3% of Chinese citizens were internet subscribers, ranging from less than half of one percent in Guizhou to over 15% in Beijing. The diffusion trend across selected provinces is represented graphically in Figure 1. Variation in mobile phone access was even more dramatic, with over 44 mobile subscriptions per 100 residents in Beijing to just over four in Tibet. Though these gaps persist, the percentage increase over the years covered by our dataset are most dramatic in China's poorer regions. Though internet diffusion increased by over 300 percent in Beijing over these years, the corresponding figure in

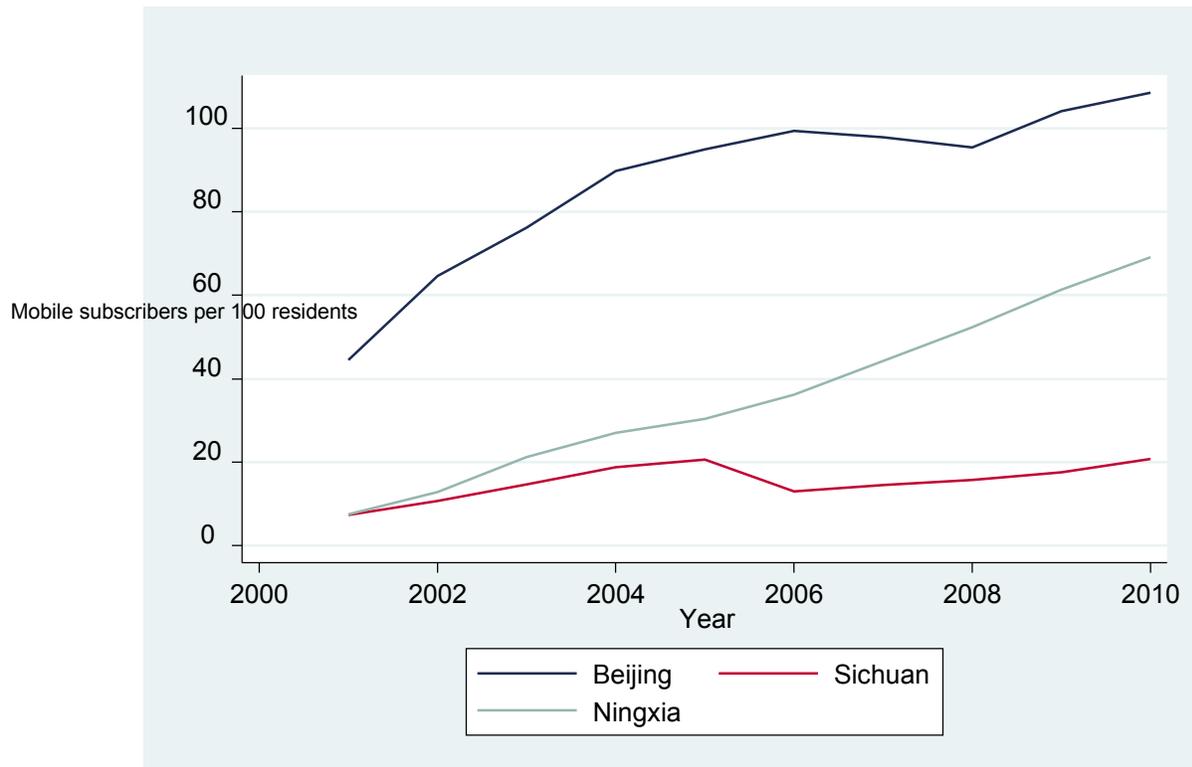
Guizhou was over 4000 percent. Mobile phone penetration across years for selected provinces is represented graphically in Figure 2. Though a persistent digital divide remains, then, empirical estimation is facilitated by variation both across provinces and across time. Most importantly, the changes in internet access across the years covered by our dataset are far from marginal, and are of greater magnitude than changes in the determinants of internet access over the same years. For instance, against this difference in magnitudes of more than a factor of ten, the percentage increase in real per capita income and education levels in Guizhou exceeded that in Beijing by a factor of two.

Figure 1. Internet penetration rate, selected provinces



Notes: Line reflects represents internet diffusion across selected years. Data are available beginning in 2001. Internet penetration is defined in percentage terms with reference to number of internet subscribers in province. Beijing, Shanxi and Guizhou are selected as representative of high, medium and low levels of subscribers, respectively. Source: National Bureau of Statistics, various years.

Figure 2. Trend in mobile phone penetration rate, 2001-2010, selected provinces.



Notes: Line reflects represents mobile subscribers per 100 provincial residents. Beijing, Ningxia and Sichuan selected as representative of high, medium and low levels of subscribers, respectively. Source: National Bureau of Statistics, various years.

There is anecdotal evidence that information obtained via ICTs is perceived by citizens as more credible, and that ICTs have facilitated new forms of collective action which has motivated greater government responsiveness to citizen demands. Collective action can take the form of both traditional instances of mobilization “in the street” and in what Tong and Lei (2013, 300) describe as “microblog mass incidents”. Protests against a proposed chemical plant in Xiamen, Fujian province which began in 2007 depended on bloggers to circumvent an information blockade imposed on traditional media to spread information about the proposed parazylyene (PX) plant. A single message publicizing the

health dangers posed by the plant spread to 1.5 million Xiamen residents (Hung, 2013, 47). As Hung puts it:

many citizens and netizens responded to the call from these widely circulated SMS messages, along with discussions on other online fora, to show up on the streets and defend their livelihoods ... the waves of heated mobile phone text messaging and online petitions that strongly opposed the construction project played a significant role in prompting and mobilising about 10,000 local citizens to take to the streets (Hung, 2013, 48).

Public hearings ensued, and the decision was eventually made to relocate the plant.

Similar events transpired in Dalian in 2011⁴⁴ and Kunming in 2013⁴⁵, also in response to proposed PX plants. The internet has also been credited with an important organizing and publicizing role in the 2011 protests in Wukan, Guangdong province, over government-imposed land sales and other issues. These protests resulted in the fleeing of local officials and police, the surrounding of the village by police forces, the intervention of Guangdong's governor and the holding of village elections which were won by one of the protest's organizers (Wines, 2011; Jacobs, 2012; Wong, 2011).

There is mounting anecdotal evidence that the diffusion of ICTs has enabled a form of citizen journalism that performs a monitoring function which, in comparison to state controlled and state regulated traditional media, is more akin to that performed by free media in more open societies. Examples abound. In the wake of a high-speed train crash outside of Wenzhou, Zhejiang province in 2011, government officials blamed weather conditions and attempted, quite literally, to bury the incident by covering the damaged

⁴⁴ "China protest closes toxic chemical plant in Dalian", BBC News, <http://www.bbc.co.uk/news/world-asia-pacific-14520438>

⁴⁵ "Fresh protests in China's Kunming over chemical plant", BBC News, <http://www.bbc.co.uk/news/world-asia-china-22550022>

cars with rubble. Weibo users at the site posted about the incident within minutes, while state television carried news of a mass murder in Norway. Within five days, 26 million Weibo messages had been posted on the subject. Officials opened an investigation. An incident at Hebei University in 2010, in which a college student was killed by a reckless driver who, upon being confronted, is alleged to have invoked his father's powerful position on the local police force to suggest invulnerability to prosecution, gave rise to the Weibo meme, "My father is Li Gang" (Wines, 2010; Hassid, 2012). While the government initially reacted with instructions to censor coverage of the incident, growing online discontent is credited with forcing the driver's arrest. Another recent case was the commuting, in response to an online outcry, of a death sentence for a private lender in Zhejiang province accused of bribing local officials (Wang, 2012). In 2009, the case of a 21 year-old woman, Deng Yujiao, attracted national attention after receiving online publicity. Deng, who had killed a Communist Party official in self-defence in an effort to ward off sexual assault, had her murder charges dropped after an online public outcry (MacKinnon, 2012). A wave of online protest was also instrumental in securing the release of Tang Hui, a woman from Hunan province who had been jailed after protesting against lenient sentences for perpetrators who abducted and forced her daughter into prostitution ("Demanding Justice", 2012). In some cases, online protests seem to have precipitated policy changes. An online public outcry in the wake of the death in police custody of Sun Zhigang, who was arrested by Guangzhou police for not carrying his local residence permit, led to the elimination of a detention system for internal migrants that had existed for decades (Hassid, 2012, 19). In another case, photographs of a Party chief from Shaanxi province at the scene of a bus crash appeared to show the official wearing

an expensive watch, presumably beyond the means of his government salary. Netizens scoured the internet for other images of the official, finding that he sported an impressive collection of luxury watches. Shortly thereafter, local officials announced he was under investigation (Wan, 2012). Even past cases of suspected misconduct have been fuel for online outrage at the perception of extralegal privileges enjoyed by officialdom, the unsolved poisoning of a Chinese university student in 1995 being an example. At the time, the student's roommate, thought to be from a well-connected family, was a prime suspect. Investigators dropped the case. Its revival on the blogosphere was initially censored, which appeared only to add fuel to the fire. Yao Chen, a Chinese film star with more than 45 million Weibo followers, wrote "Nineteen years ago, the young Zhu Ling was poisoned. Nineteen years later, this name has again been poisoned" (Jacobs, 2013)⁴⁶.

Some reformist elements within the Chinese state have cheered these developments, touting ICT diffusion and e-government reforms as important developments in the establishment of "online democracy"⁴⁷. Recognition by Chinese leaders that state officials' monopoly on information about government policies creates incentives to use discretionary power toward corrupt ends dates at least to 1987, when the Communist Party implemented the "Two Disclosures and One Monitoring" campaign, which mandated disclosing administrative rules and, in principle, granted the appropriateness of public monitoring of government practice (Plotrowski et al, 2009). Subsequent moves promoting transparency and reduced discretion on the part of state officials can be seen as

⁴⁶ In response to the censoring of, and subsequent reporters' strike at the liberal newspaper Southern Weekend, Yao tweeted a quote from Aleksander Solzhenitsyn: "One word of truth outweighs the whole world" (Wong, 2013).

⁴⁷ "China hails 'online democracy' as Wen goes live on the web", China Media Project, <http://cmp.hku.hk/2009/03/02/1502/>

reflective of a desire on the part of central leaders to transform China into a “regulatory” state (Yang, 2004).

Since the late 1990s, information technology has been viewed as a tool that might aid in this transformation of the relationship between different levels of government and their affiliated departments, and between citizens and government. China introduced a “Government Online Project” (GOP; *Zhengfu Shangwang Gongcheng*) in 1999. The stated goals of the project are to make information about government available online, including government documents and archives, and to implement online government administration, thereby enhancing efficiency (Ma et al, 2005). The central government has hoped that taking more of government online will increase transparency. Though in general terms these goals have been imbedded in a series of “Golden Projects” making use of the tool of e-government (Zhang et al, 2008), the adoption of Open Government Information (OGI) legislation by several Chinese cities in the early 2000s has been hailed as “pathbreaking” in that the legislation establishes the presumption that government information should be disclosed, and mandated the institution of procedures for the disclosure of information upon request. The legislation applies to all government departments within the adopting jurisdiction (Horsley, 2006). In a 2011 editorial, People’s Daily defined OGI as “a basic drill for democracy”⁴⁸. In early 2013, China’s new premier, Li Keqiang, emphasized the importance of OGI in “allow(ing) the masses to effectively supervise the government”⁴⁹.

⁴⁸ (Zheng wu gong kai shi ji ben de min zhu xun lian” (Open Government Information is a basic drill for democracy) <http://view.news.qq.com/a/20110902/000022.htm>

⁴⁹ “Li Keqiang urges more information openness”, translation by China Media Project, <http://cmp.hku.hk/2013/03/27/32125/>

OGI legislation was first adopted by the southern city of Guangzhou, effective January 1, 2003. By the time national legislation took effect in 2008, a total of twenty-four Chinese cities and provinces had adopted OGI legislation.⁵⁰ The Guangzhou city government described the goals of OGI as follows:

Open government information is a precondition for scientific management and effective use of government information resources, a basic requirement for government informationization, and also a requirement for government management reforms, for strengthening government work transparency, for safeguarding citizens' right to know, and for comprehensively fulfilling the requirements of World Trade Organization (WTO) rules (Guangzhou Municipal Government Legal Affairs Office, 2004).

Among the key provisions of the Guangzhou legislation, seconded by later OGI adopters, are:

- All “information made, obtained or possessed in the course of managing or providing public services by all levels of government and its functional departments and organizations that carry out administrative powers” should be made public.
- Public release of such information is to be the rule, the withholding of such information the exception.
- The government must disseminate the financial budget report, including information on government purchasing and major capital construction projects.

⁵⁰ For a complete list, see Table 1.

- Those with a responsibility to publicly disclose such information may not charge fees for its release.
- Officials and departments with an obligation to release government information must outline strategies and policies for so doing.
- Items to be made public include those concerning governance, finance, administrative procedures, decision-making processes,
- This information must be made public through “a unified government comprehensive gateway website” (Guangzhou Municipal People’s Government, 2002).

Some scholars, however, are skeptical that the expansion of internet access translates into a citizenry better informed about government or interested in bringing about greater government responsiveness. Commenting on the use of microblogs in particular, Hassid (2012, 10) notes that “Sina Weibo (a popular microblogging platform) users post more content about astrology and horoscopes than both corruption and the politically disputed Diaoyu/Senkaku Islands combined”. The CNNIC estimates that as of the end of 2010 77% of internet users consume news online, 35% shop online, and 67% engage in online gaming. 77% engage in instant messaging and 51% use social networking websites, and 14% are active on microblogs (CNNIC, 2011). Moreover, attempts are made to censor the information available, reflecting concern in some quarters of the regime as to the potential for ICT diffusion to lead to civil disorder (Hassid, 2012, 5). For instance, a highly placed propaganda official in Shaanxi province who is also a vice-chairman of the

All China Journalists Association warned that the Party's control of media was as paramount as its control of the military, and that this control was threatened by the internet.

Just like the (idea of) the Party controlling the military ..., the Party's control of the media is an unassailable basic principle in terms of upholding the Party's leadership, and under the current situation this (principle) can only be strengthened and must not weaken. Today, some web users use the internet to give vent to their anger, to generate and disseminate rumors, to mislead the people, and even to evade the privacy of others, and these are internet crimes. A number of so-called internet personalities manipulate sensitive incidents, maliciously attacking the current system, blaming and blackening the name of the Party and the government, in some cases even inciting the subversion of the Party's leadership and its political rule.⁵¹

Estimates of the number of government officials charged with manning the "Great Firewall" vary, though a figure in the tens of thousands seems to be the consensus.⁵² This perhaps understates the scope of government attempts to shape internet debate, as there are thought to be a quarter of a million members of the so-called "50-cent party" (*wumao dang*), who promote online comments sympathetic to the aims of the propaganda department in return for small payments⁵³. Moreover, microblogging services employ self-censorship. Sina Weibo employs thousands of monitors and advanced software to maintain regime confidence in the company's conformation with government priorities (Sullivan, 2013, 5). In sum, this has led one scholar to argue that if the internet has opened a new public space, it is one the regime is actively trying to "occupy" (Zhou, 2006, 146). This guidance of public opinion is reinforced by the threat of severe

⁵¹ Ren Xianliang, writing in *Red Flag Journal*. Translation by David Bandurski (2013) via China Media Project, <http://cmp.hku.hk/2013/04/12/32599/>

⁵² King et al (2012) cite estimates of 20,000-50,000. Watts (2005) reports 30,000.

⁵³ For a discussion, see "Venting Mechanisms" at <http://cmp.hku.hk/2010/04/26/5754/>.

penalties for those distributing information deemed threatening to the interests of the party-state. To take only two examples, in 2004, a three year sentence was handed down to a reporter on the Beijing staff of the New York Times who obtained information relating to Jiang Zemin's status as head of the Central Military Commission (Shirk, 2008), and in 2005, a Chinese journalist was sentenced to ten years in prison for sending an email to an overseas pro-democracy website ("Plus ca Change," 2012).

Lei's (2011) survey research suggests, however, that compared to consumers of traditional media, Chinese netizens "are more likely to simultaneously embrace the norms of democracy, be more critical of the political conditions and the party-state, and be willing to engage in politics. Lastly, Chinese netizens are also more likely to have experience in collective action" (2011, 309). At a minimum, there is evidence that Chinese netizens view the internet as a valuable source of information. In 2005, the Chinese Academy of Social Sciences (CASS) asked internet users to liken the internet to a series of metaphors. 84.5% of respondents found "information center" to be an adequate analogy, compared with 25.2% for "a shopping center", 41.5% for "entertainment place" and, interestingly, 41.1% as a "meeting place" (Tai, 2006, 172). Moreover, there is evidence that Chinese citizens view information received via the internet as more credible than that from traditional sources, and that users are aware of the political implications of this new source of information. As part of an international study on internet attitudes conducted by the UCLA World Internet Project, the Chinese Academy of Social Sciences asked Chinese citizens whether they agreed with the following statements: "Do you think that by using the Internet, people like you can have more say about what the government does?" and "Do you think that by using the Internet,

people like you can better understand politics?” What is remarkable is not merely that 60.8% and 75.2% responded affirmatively to these questions, respectively, but that these numbers dwarfed those found in other countries surveyed.⁵⁴ Moreover, Chinese respondents’ likelihood of agreement was not predicted by their age, income, education or marital status (Tai, 2006, 201). Agreement with the latter statement should be understood in the context of the historical baseline in China of state-dominated media. Despite the considerable efforts of the regime to limit the sharing of information and to stake out a position in this new sphere of opinion, it must be recognized that given this baseline, even marginal moves in the direction of low-cost, accurate information about government can have large effects. Unsurprisingly, blogs have become a forum for political discourse of a sort impossible in traditional media. They have also been the site of a revival of China’s long dormant tradition of political satire (Esarey and Qiang, 2008).

2.2. Government responsiveness

I measure government responsiveness with reference to the composition of government spending. State agents are not indifferent to this composition, nor, it goes without saying, are citizens. Despite the difficulties in aggregating citizen preferences, we can state with some confidence that some compositions of government spending are more responsive to the demands of either citizens or state agents. Berry and Lowery (1987) suggest a stark distinction between government transfers, of which citizens are the primary beneficiaries,

⁵⁴ The UCLA World Internet Project also surveyed citizens in Chile, Hungary, Italy, Japan, South Korea, Singapore, Spain, Sweden and the United States. For further discussion, see Tai (2006, 201).

and government investment purchases, labour but especially capital, which are preferred by state officials. This preference is driven by the potential for bribes and by the preference of state agents for larger staffs and operating budgets. Transfers, where revenues from taxation are redistributed to citizens, do not carry the same associated benefits. Moreover, to the extent that transfers are based on long-term commitments, they imply less discretion on the part of officials over disbursement, which also hampers the generation of bribes. Capital construction, on the other hand, typically has a highly discretionary component in terms of the location, size and design of the project (Tanzi and Davoodi, 1998, 4). The large size of public investment projects incentivizes potential contractors to bribe those holding discretionary power. Tanzi and Davoodi (1998) also note that when this bribe is awarded in percentage terms, governments have an incentive to increase the scale of the investment project. Thus where officials are in a position to extract “kickbacks”, they will display a preference for large capital investments relative to other forms of spending. Hence the “white elephant” phenomenon – capital intensive projects “with little value in promoting economic development” (Rose-Ackerman, 1999, 30). “Spectacular anecdotes”, to quote Pritchett (1996) abound, including nuclear power and steel plants whose products never materialized. Rose-Ackerman cites the rather remarkable example of Nigeria’s orders for cement in 1975 being on such a scale that they “exceeded the productive capacity of Western Europe and the Soviet Union” (Rose-Ackerman, 1999, 31). Canning and Fay (1993) demonstrate remarkable discrepancies in the per kilometre road construction costs across states.

This bias toward capital investment in less responsive states is reinforced by the expectation that officials will discount the future more heavily than citizens. For state

agents the benefits from government spending, kickbacks, are concentrated at the time of investment, whereas for citizens the benefits accrue over a longer time horizon. The kickbacks of a given construction project which begins at time t are enjoyed at time t , or even $t-1$, whereas the cost of cutting corners in construction or the pursuit of capital investments of little economic value is borne by citizens at time $t+n$ (Rose-Ackerman, 1999, 31).

Extracting kickbacks from labour may be more difficult, and hence it is predicted that less responsive governments will devote a greater share of expenditure to capital-intensive investment than to the provision of relatively labour-intensive services such as education and health care. This has been borne out by cross-national studies of corruption perceptions and the composition of government spending. Mauro concludes that “it will be easier to collect substantial bribes on large infrastructure projects or highly sophisticated defense equipment than on textbooks or teachers’ salaries”, and finds that corruption reduces government spending on education (Mauro, 1998, 264). Nyamang and Schoeman (2010) come to the same conclusion in their study of corruption and expenditure composition in Africa. Delavallade (2006) also found that corruption reduced the share of government expenditure on education and health in a study of 64 countries. These findings are robust to wealth levels and the population’s age dependency ratios.

Comparative studies among OECD countries have also demonstrated an association between social spending and government responsiveness. Lindert (2004) finds that in the postwar period, social spending is highly sensitive to voter turnout and to turnover in the office of the chief executive. In the period dating from the late 19th century to 1930,

voting rights are similarly predictive of social spending. Lindert concludes that democratic pressures are “a stalwart explanatory factor” (2004, 79) in accounting for differences in social spending across states, making social spending a useful proxy for government responsiveness.

Scholars note two key features of Chinese education and health expenditures in the post-reform years. Firstly, a move to decentralize education finance to sub-national government began in the early 1980s (Ngok, 2007). Decentralization has been accompanied by higher levels of out of pocket spending on both health and education for Chinese citizens, particularly in rural areas. Secondly, this has given rise to inter-provincial variation in spending levels and outcomes. Zhang and Kanbur (2005) note that whereas health indicators in Shanghai are comparable with those in advanced states, those in the poorer provinces more closely resemble levels found in the world’s poorest countries. World Health Organization (WHO) data from 2000 indicate that relative to states at comparable levels of development, China lags in per capita health spending.

In contrast, though China began the reform period at a low infrastructure base, there is a growing consensus that China’s capital spending on infrastructure is extremely high by historical standards. Investment in rural roads rose at an annual rate of 51 percent between 2001 and 2004 (Liu et al, 2009). A 2009 study undertaken by Pivotal Capital Management warned that China’s capital spending boom “is now outstripping previous great transformation periods” (2009, 1), with the ratio of gross fixed capital formation to GDP far exceeding what was seen at the heights of South Korea, Japan and German’s postwar booms. “China consumes more cement than the rest of the world combined” (ibid, 5) and the economic rationale for many investment projects has become

questionable. China's length of highway is already comparable to that found in the United States, though China currently has about 1/6th as many vehicles. Despite having 1/5th the number of rivers as the United States, China has 5/6th the number of bridges. The authors note that "bridges are a great example of the kind of promiscuous spending on infrastructure that mars China. In the past, countries like Japan used to be ridiculed for their 'bridges to nowhere'. China has already dethroned Japan in that category: 6 out of the top 10 and a spectacular half of the top 10 longest suspension bridges are in China" (ibid, 8). Shi and Huang (2013) similarly find that while Chinese provinces had arguably under-invested in infrastructure prior to 1997, by 2008 most of the Western provinces had clearly over-invested. More recently, the central government took the dramatic step of implementing a five year ban on the construction of new government buildings.⁵⁵

The present analysis is conducted at the provincial level. China's decentralized political economy (Montinola, Qian and Weingast, 1995) justifies this focus, and enhances our confidence that the level of government at which expenditure decisions are made is the same at which ICT diffusion adjust the incentives of government. Not only have the reform years seen a devolving of responsibility for government spending on health and education (Zhang and Kanur, 2005; Ngok, 2007), but the importance of central government transfers as a component of provincial revenue has also declined in the reform years. This is demonstrated empirically by Jin, Qian and Weingast (2005) who find that provincial revenue collection and local expenditures are highly correlated.

⁵⁵ "China bans construction of government buildings for five years", *The Financial Times*, <http://www.ft.com/intl/cms/s/0/352ea1a6-f40d-11e2-942f-00144feabdc0.html#axzz2apHcRHZH>

3. Theoretical Framework

The China-specific literature on the political implications of ICT diffusion is, by and large, silent on the causal mechanisms by which this diffusion might be translated into more responsive government. Nor have there been attempts to demonstrate empirically whether the anecdotal evidence cited above is representative of a systematic relationship between information access and government responsiveness. In this section I consider a collective action mechanism that may explain an observed association between these variables before turning, in the subsequent section, to an identification strategy enabling empirical investigation.

Explanations for an association between information and government responsiveness in autocracies cannot rely on electoral mechanisms. Largely unconsidered by the literature is the possibility that this association is mediated by a reduction in the cost of collective action. That citizens and authoritarian states can ensure some degree of accountability in government through the exercise of collective action, or the threat thereof, is well established (Tilly and Tarrow, 2007). Moreover, it has also been suggested that technological change can reduce the costs associated with collective action, and thereby increase its likelihood (Lin and Nugent, 1995, 2230). I build on these insights to construct a collective action mechanism which incentivizes greater government responsiveness. I argue that its probability of activation is raised by the diffusion of ICTs.

Collective action is “voluntary contribution to a public good that will be provided if the number of people who contribute is sufficiently large” (Lohmann, 2000, 659). Citizens have a collective interest in more responsive government. Assume that the means of

attaining more responsive government is through some form of collective action which incentivizes government to allocate spending in a manner more responsive to citizen demands. If a sufficient threshold of citizens participate in the collective action, the collective benefit is attained. These benefits have public good characteristics to the extent that government spending on health and education cannot be selectively denied to citizens who have not contributed equally to the winning of this more favourable composition of spending. Attaining these goods through collective action is, therefore, subject to free rider problems since one risks incurring costs by engaging in collective political action in China. Facing these costs, and given that the benefits of collective action cannot be denied to him, the rational citizen will prefer to “free ride” on the risky actions of others (Hardin, 1968; Olson, 2009). When this tendency is widespread, collective action does not happen and government has no incentive to adjust the composition of its expenditure to better respond to citizen preferences.

Joining collective action is a strategic choice in the sense that the cost of participation depends on the number of other individuals participating in collective action. Given this, it is useful to model the likelihood of an individual deciding to join a collective action as deriving from individual-level determinants and also from the individual’s expectations of the behaviour of others. At the individual level, an important determinant is the individual’s subjective valuation of the benefits of responsive government. The benefits of an adjustment in the composition of government spending are not equally valuable to all citizens, and so the utility to citizens of a given bundle of government expenditure is not uniformly distributed. The elderly, for instance, may value government health spending more than the young, and parents with young children may value education

spending more than the elderly. Beyond variation in subjective evaluations of the goods obtained through collective action, some citizens are more responsive than others to the expected costs of collective action. That is, levels of risk aversion are distributed among the population. This distribution can be represented by the number of other citizens an individual would need to see engaging in collective action before the perceived cost was not deemed prohibitive, holding the utility of the good constant. This conceptualization of the distribution of risk tolerance is rooted in the intuition that the expected cost of collective action in terms of regime sanction is lower where the absolute numbers so engaged is higher. When ten people engage in collective protest in the city square, they are likely to be arrested. When several hundred thousand do so, the likelihood of any individual being arrested is lower. The expected cost of being the marginal joiner is thus lower in the larger protest.

This distribution of risk tolerances can be translated into a distribution of thresholds beyond which individuals are willing to join the collective action. Collectively, these individual thresholds can be arrayed in a “threshold sequence” (Kuran, 1995, 250). The nature of this threshold sequence determines the likelihood of collective action. If the distribution is favourable, a cascade will ensue given that people’s decision to join the action are interdependent (Lohmann, 2000, 657). Consider Figure 3 below, taken from Kuran (1991, 19).

Figure 3. Illustration of threshold sequence

A	B	C	D	E	F	G	H	I	J
0	20	20	30	40	50	60	70	80	100

Notes: Letters represent individuals who are potential joiners of collective action. Participation of individuals A through J is required for collective good to be acquired. Numerals represent number of individuals the corresponding individual needs to see participating in collective action before he or she will likewise join the collective action. Source: Kuran (1991, 19).

Individuals are represented by letters in the first row. Assume that if all individuals A through J participate in the collective action, the citizens succeed in obtaining the collective good. The numbers in the second row represent the percentage of their fellow citizens who must be seen as engaging in collective action without penalty before the individual is willing to engage him or herself. Person A is willing to be the first mover. In the Chinese context, this person is a committed dissident. Person I, however, is relatively risk averse and will only join the collective action if 80% of potential actors are seen as participating without incurring costs.

Kuran (1991, 1995) emphasized the ultimate unpredictability of collective action given that this distribution risk aversion levels is unobserved. If risk tolerance levels are unknown, it is impossible to identify in advance the threshold at which the cascade will ensue. Depending on the distribution of risk aversion, any one of actors A through J could be the determining joiner of the collective action. In the distribution in Figure 3, a cascade does not happen, as B requires 20% participation where in fact A is the lone participant. The thresholds of individuals C through J are not approached. Note the sensitivity of the sequence to the distribution of risk tolerance. If B were to require only

10% participation, this would be provided by A. C's 20% requirement would be met by B's participation, D's 30% requirement would be met by C's participation, and so on in fulfillment of the cascade until all citizens are participating, collective action is achieved and the collective good is enjoyed.

Given that the risk distribution is unobserved, can we thus say nothing about the likelihood of collective action? A solution is suggested by Schelling (1978), who in his discussion of critical mass phenomena referred to these distributed thresholds as *expected* number of joiners. That is, in the diagram above E joins when he or she expects 40% participation, not when this level of participation is observed. If we grant that there is a time inconsistency between the decision to join and the act of having joined the collective action, then we can investigate the drivers of the participation rate expected by an agent. If changes in these drivers are observable, we can make predictive statements as to the direction of their effect on the average individual's choice, and thus about the likelihood of collective action.

We can thus add the individual's expectation of the participation rate to the determinants of his or her likelihood of engaging in collective action. This expectation is itself responsive to the cost of information. Expectations are driven by knowledge of others' intentions. Intentions are signalled by others, and received as information by the agent. The cost of signalling intentions, including the intention to engage in risky forms of collective action, is reduced by ICT diffusion. Whatever risks nevertheless remain are balanced by the greater numbers who can be reached via the new medium. Given this reduced cost of signalling an intent to engage in collective action to a given number of potential joiners, and the general interest in obtaining collective goods, we would expect

more citizens to signal their intention to engage in collective action after ICT diffusion than previously. Having received this high volume of signals of intent via ICTs, the individual citizen adjusts upward his or her expectation of the number of citizens who will engage in collective action.

To review, the likelihood of an individual's participation is a function of individual-level determinants (the subjective valuation of the collective good and risk aversion re. participation in collective action) which can be expressed in an individual-specific participation threshold. Participation is also a function of the expected number of participants, which itself is responsive to the cost of information. All else equal, then, we expect that reduced information costs will increase the likelihood of an individual's participation and therefore the likelihood of a collective action cascade being enabled.

An important wrinkle should be added to our understanding of this process, however. Evolutionary biologists and psychologists have long recognized that manipulation is an important component of communication (see, for example, Krebs and Dawkins, 1984). Given that agents have an interest in attaining the benefits of the collective good without bearing the costs of collective action, and knowing that other individuals' probability of joining is shaped by their expectations of others' behaviour, ICT diffusion presents an opportunity. Under ICT diffusion, the agent inclined to free ride may signal a false intention to join the collective action in hopes that this will stimulate others to participate, raising the likelihood of a threshold cascade and provision of the collective good. This is particularly attractive given the low cost of signalling to numerous agents using ICTs. If other agents are highly credulous, this low cost signal may have a larger effect on the number of joiners than the signaller's higher cost option of joining the collective action

him or herself. Less credulous agents will discount the signals received by a “skepticism rate”. Thus the effect of reduced information costs on the expected participation rate are tempered by the possibility of signals’ manipulative intent. How significant is the downward effect of the skepticism rate? It is important to emphasize the magnitude of the reduction in signaling costs afforded by ICT diffusion. This, coupled with the general interest in seeing more participants in the collective action, implies dramatic increases in the pre skepticism-discounted likelihood of collective action relative to pre-ICT days. Thus any skepticism rate short of complete skepticism still implies, as ICT diffusion increases, a higher expected participation in collective action than in the ICT-free counterfactual.

Chinese officials are sensitive to increases in the likelihood of collective action. Though reliable data are not available, there is a consensus that mass incidents have become more common in recent years. Sun Liping, a sociologist at Tsinghua University, estimated that 180,000 such incidents occurred in 2010. In China, local officials’ advancement, while heavily dependent on economic performance, also requires the maintenance of social stability, measured by the prevalence of collective action (Edin, 2003). Two courses are open to state officials faced with the increasing likelihood of collective action. One is to take steps to reduce the spread of calls to collective action. Recent empirical work provides strong evidence that web censors in China are more likely to remove blog posts urging collective action than those which merely criticize government. Indeed, King, Pan and Roberts conclude that “the purpose of the censorship program is to reduce the probability of collective action” (2012, 2). The other response is to pre-emptively adjust government behaviour so as to better respond to citizen preferences, thereby heading off

collective action which may have consequences more costly than the benefits forgone by an adjustment of the composition of government spending.

4. Data and estimation strategy

This section develops an estimation strategy which I submit as a test of the following hypotheses.

H₁: Ceteris paribus, provinces with higher rates of ICT diffusion will devote a greater share of government expenditure to health.

H₂: Ceteris paribus, provinces with higher rates of ICT diffusion will devote a greater share of government expenditure to education.

H₃: Ceteris paribus, provinces with higher rates of ICT diffusion will devote a lesser share of government expenditure to capital investment.

The hypotheses are evaluated using panel data from Chinese provinces for the period 2001-2010 as reported by China's National Bureau of Statistics. The sample begins with data for 2001 as this is the first year the measure of internet use adopted here is reported. One proxy for our dependent variable, that involving capital construction as a share of expenditure, is available only to 2006. Where data are complete, 310 province-year observations are collected.⁵⁶ For the supplemental analysis of the effects of OGI legislation, it is hypothesized that adoption of OGI legislation predicts a greater share of expenditure devoted to health and education, and a lesser share to capital investment.

⁵⁶ For operational definitions and sources for all variables, see Appendix A.

4.1. Independent variables

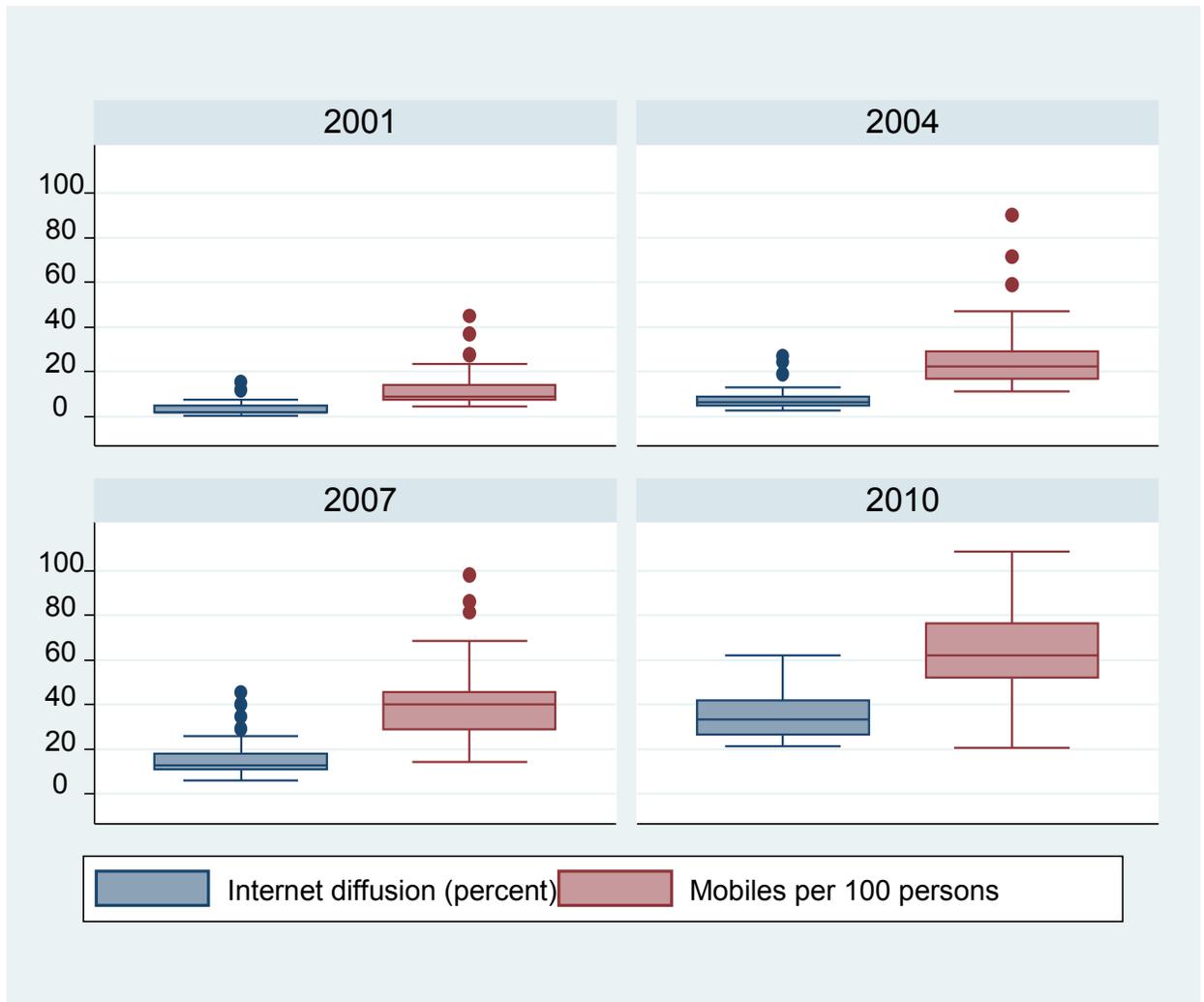
The paper's estimation strategy takes advantage of variation in our main independent variables, measures of ICT diffusion, across provinces and time. Fortunately, the data examined here represent the initial stages of ICT diffusion across China, during which time this variation is far from marginal. The mean level of internet diffusion across provinces increased nearly tenfold between 2001 and 2010, and the mean mobile subscription rate by more than fourfold.

Internet diffusion is operationalized as internet subscribers as a share of provincial population. In order to determine whether the effect of mobile phone penetration is distinct from that of internet diffusion, I also report mobile phone subscription rates. The years sampled here are marked by increasing diffusion of ICTs throughout China, and also of increasing variation across provinces. This is represented graphically in Figure 4. The existing literature has emphasized that mobile phone diffusion in the developing world is less income-dependent than internet diffusion, largely owing to the lower requirements for existing telecommunications infrastructure. In China, however, the increases in internet access have been even more dramatic than in mobile telephone access, and the latter is less strongly correlated with income in our sample⁵⁷. Despite these peculiarities, a comparison between the effect of internet and mobile diffusion on responsiveness remains instructive. Though the information available via an internet connection is expected to be higher than that available via a mobile phone subscription, mobile access may facilitate faster communication across a large network, thereby facilitating effective collective action. Even where the sign on these two variables is the

⁵⁷ The coefficient of correlation between income and mobile phone penetration is 0.857. For income and internet penetration, the figure is 0.800.

same, a comparison of the magnitude of the estimated coefficients may indicate whether the information channel or the collective action channel is more important for generating responsiveness.

Figure 4. Box plot of ICT diffusion across Chinese provinces, selected years



Notes: Province is unit of analysis. Larger spread among cases within year reflects higher variance among provinces in levels of internet/mobile penetration.

I also include, by way of a placebo test, specifications which measure citizens' access to information from traditional print media. These sources are more dominated by government to citizen transmission, and are thus a source of less reliable information about government⁵⁸. Moreover, the consumption of these media does not facilitate the collective action mechanism described above. Access to print media is operationalized as the number of newspapers and magazines purchased annually per 100 provincial residents⁵⁹. All data for these variables is available from various editions of the National Bureau of Statistics' China Statistical Yearbook.

In some of the specifications reported below, I also estimate the coefficient on OGI adoption. This is done by including a dummy variable which takes a value of 1 when OGI laws are in effect in a province. As can be seen in Table 1, of the 24 jurisdictions which adopted OGI legislation between 2003 and 2008, when national legislation was adopted, nine were provinces, four were province-level municipalities and nine were provincial capital or sub-provincial cities. The OGI dummy enters specifications in three forms. In one set of specifications, it takes the value of 1 when the province or a city located therein has adopted OGI legislation. After national OGI adoption in 2008, it takes the value of 1 in all provinces. The staggered nature of the OGI adoption process enables us to estimate the effect of OGI on expenditure composition using a switching

⁵⁸ Djankov et al (2001) show that media consumption is lower where state ownership is higher.

⁵⁹ It would be instructive to run an additional placebo test using citizen access to television, which is heavily controlled by government. The National Bureau of Statistics provides data at the province level on televisions owned per 100 rural and urban households. However, their data do not provide consistent definitions of the urban-rural population ratio at the province level across the years covered by our sample. Moreover, the content available to television viewers varies dramatically across China, whereas the content available via an internet connection is broadly similar regardless of location with the country. Regressions using the urban household penetration of television sets show no consistent impacts, and the sign of the estimated effect is sensitive to the inclusion of province and year fixed effects. These results are not presented here owing to the poor quality of the data, but are available from the author upon request.

replication design. Under switching replications, the initial adopter (in this case Guangdong, in which the city of Guangzhou adopted OGI in 2003) serves as the treatment, and additional jurisdictions as controls. When these controls later adopt OGI legislation themselves, Guangzhou is a “continued-treatment control” (Shadish et al, 2002). Jurisdictions which did not adopt OGI in the observed period serve as controls throughout. This approach strengthens both internal and external validity, as it demonstrates effects of OGI adoption in different years and different jurisdictions. The design is diagrammed in Figure 5 below.

Table 1. OGI-adopting cities and provinces

Adoption date	Name	Jurisdiction type
01/01/2003	Guangzhou	City
05/01/2004	Shanghai	City/province
04/01/2004	Shenzhen	City
09/22/2004	Beijing	City/Province
07/01/2004	Chongqing	City/province
05/01/2004	Chengdu	City
10/01/2004	Gansu	Province
05/01/2004	Kunming	City
10/01/2004	Jinan	City
11/01/2004	Ningbo	City
10/30/2004	Changchun	City
04/01/2004	Wuhan	City
10/01/2004	Hangzhou	City
07/22/2004	Jilin	Province
01/07/2004	Hubei	Province
01/07/2004	Hebei	Province
01/01/2006	Suzhou	City
10/01/2005	Hainan	Province
01/10/2005	Guangdong	Province
01/01/2006	Shaanxi	Province
01/02/2006	Liaoning	Province
04/01/2006	Heilongjiang	Province
09/01/2006	Sichuan	Province
09/01/2006	Jiangsu	Province
05/30/2008	Tianjin	City/Province

Sources: Law Library (in Chinese), links to government documents on adoption of OGI legislation, http://www.lawib.com/law/law_view.asp?id=90113. Supporting secondary sources: Legislative Affairs Office of the State Council, P.R.C. <http://www.chinalaw.gov.cn/article/jggz/fzxxgz/200612/20061200064544.shtml>
See also Snell and Weibing (2007), Plotrowski (2009), Horsley (2007).

Figure 5. Switching Replications Design, OGI Adoption in Chinese Cities and Provinces

Province/ City															
Treatment group 1	O- 2001	O- 2002	X	O- 2003		O- 2004		O-2005		O-2006	O- 2007	XN	O- 2008	O- 2009	O- 2010
Treatment group 2	O- 2001	O- 2002		O- 2003	X	O- 2004		O-2005		O-2006	O- 2007	XN	O- 2008	O- 2009	O- 2010
Treatment group 3	O- 2001	O- 2002		O- 2003		O- 2004	X	O-2005		O-2006	O- 2007	XN	O- 2008	O- 2009	O- 2010
Treatment group 4	O- 2001	O- 2002		O- 2003		O- 2004		O-2005	X	O-2006	O- 2007	XN	O- 2008	O- 2009	O- 2010
Control Groups	O- 2001	O- 2002		O- 2003		O- 2004		O-2005		O-2006	O- 2007	XN	O- 2008	O- 2009	O- 2010

Treatment group 1 (2003 adopters): Guangzhou

Treatment group 2 (2004 adopters) = Beijing, Changchun, Chengdu, Chongqing, Gansu, Hangzhou, Hebei, Hubei, Jilin, Jinan, Kunming, Ningbo, Shanghai, Shenzhen, Wuhan

Treatment group 3 (2005 adopters) = Hainan, Guangdong

Treatment group 4 (2006 adopters) = Heilongjiang, Jiangsu, Liaoning, Shaanxi, Sichuan

Control group = All non-adopting jurisdictions

O denotes observation

X = jurisdiction adoption of OGI legislation

XN = adoption of national OGI legislation

4.2. Dependent variables

Responsiveness is defined with reference to the composition of government spending.

Rose-Ackerman (1999) and Tanzi and Davoodi (1998) note that state officials in corrupt societies have a preference for spending on capital construction which, because these

purchases have a high discretionary component, enables the extraction of bribes. One proxy for government responsiveness is therefore the share of annual government expenditure devoted to new capital construction as reported by China's National Bureau of Statistics. As seen in Table 2, which reports summary statistics for all variables, there is substantial variation across provinces in the share of government spending devoted to capital spending, from 4.5% in Shandong in 2006 to 40.7% in Tibet in 2003.

Table 2. Summary Statistics for Key Variables

Type	Variable	Mean	St. dev.	Min.	Max.	Obs.
<i>Dependent variables</i>	Share, capital construction	12.22	6.28	4.48	40.74	186
	Share, health spending	4.87	1.27	2.74	8.35	310
	Share, education spending	15.62	2.58	8.56	21.80	310
<i>Independent variables</i>	Internet penetration, percent	14.71	13.22	0.46	62.85	310
	Mobile phones per 100 residents	36.40	23.49	4.30	108.55	310
	Print media	13.94	11.28	2.95	84.55	310
<i>Control variables</i>	GDP per capita	15014.53	10613.03	2835.46	56380.44	310
	Private enterprises	4.234	5.00	0.37	30.66	310
	Physical infrastructure	0.57	0.41	0.03	1.89	310
	Population density	395.12	553.46	2.14	3626.49	310
	Telephone circuits density	108.82	65.62	5.61	364.98	310
	Fibre optic cable density	0.01	0.03	0	0.37	310
	Land area	310677.4	381826.8	6350.5	1660000	310
	Illiteracy	10.27	7.79	1.7	54.86	310
	Education level	6.59	4.64	0.42	31.50	310
	Elder dependency ratio	12.01	2.46	6.95	21.88	279
Youth dependency ratio	27.16	7.81	9.64	44.65	279	

Note: Province is level of analysis for all variables. Definitions and sources for all variables available in Appendix B. Data on dependency ratios is unavailable for 2010. Data for capital construction's share of expenditure runs from 2001-2006. Source: *China Statistical Yearbook*, *China Population Yearbook* (various years).

Past research has also considered public spending on health and education as a share of government expenditure as a proxy for government responsiveness (Mauro, 1998; Delavallade, 2006). Data on provincial health and education spending are available from the National Bureau of Statistics under the budgetary categories “expenditure for public health” and “expenditure for operating expenses of education”, respectively. From this data I construct two proxies of government responsiveness which reflect the share of government expenditure devoted to health and education. Government spending in both domains in the reform period has been marked by decentralization, which has given rise to inter-provincial variation in spending levels and outcomes (Zhang and Kanbur 2005; Ngok 2007), though, as Table 2 reveals, there is less variation in these measures than in that for capital construction.

Table 3 presents yearly means from provincial cross sections on the share of government spending devoted to capital construction, health spending and education spending. A nationwide trend consistent with the hypotheses of this paper is, in the main, visible. Across the country, there was a reduction in the share of government spending devoted to capital construction between 2001 and 2006, and an increase in the share devoted to health spending between 2001 and 2010. Average education spending did not increase in the years sampled here. As the regression results below demonstrate, however, there is an association between variation in province-level changes in ICT diffusion and the share of government spending devoted to capital construction.

Table 3. Historical trends in composition of government spending,

China 2001-2010

Panel A: <i>Capital construction</i>	Mean	Std. Dev.	Obs.
Year			
2001	13.977	6.179	31
2002	14.076	7.456	31
2003	12.388	7.235	31
2004	10.715	4.719	31
2005	11.605	5.683	31
2006	10.553	5.478	31
Panel B: <i>Health</i>	Mean	Std. Dev.	Obs.
Year			
2001	4.185	0.741	31
2002	3.965	0.769	31
2003	4.353	0.818	31
2004	4.070	0.775	31
2005	4.080	0.842	31
2006	4.272	0.844	31
2007	5.265	0.891	31
2008	5.563	0.896	31
2009	6.474	0.968	31
2010	6.440	1.043	31
Panel C: <i>Education</i>	Mean	Std. Dev.	Obs.
Year			
2001	15.109	2.670	31
2002	15.406	2.822	31
2003	15.244	2.602	31
2004	14.989	2.388	31
2005	14.723	2.255	31
2006	14.608	2.273	31
2007	17.272	2.355	31
2008	17.113	2.534	31
2009	15.968	2.278	31
2010	15.760	2.325	31

Notes: Table reports means of yearly cross-sectional averages for share of government spending devoted to capital construction (Panel A), health spending (Panel B) and education spending (Panel C).

4.3 Control variables

A naïve model of the association between internet access and government responsiveness is:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \mu_{it} \quad (1)$$

where Y_{it} is one of three measures of government responsiveness and X_{it} represents ICT diffusion. If our measures of responsiveness are influenced by other factors for which controls are not introduced, pooled OLS estimates of β_1 will be biased, in that we will mistakenly attribute the influence of omitted variables to ICT diffusion. It is therefore necessary to control for observable, time-varying covariates that are likely to influence ICT diffusion and responsiveness.

Both international and China-focused studies have identified a common set of covariates which partly determine variation in ICT diffusion across jurisdictions⁶⁰. Among the systematic determinants of China's digital divide, Zhao (2002) highlights the importance of local income levels and existing telephone infrastructure. To these, Wang (2002) adds population density and education levels as important determinants. The regression model described below therefore includes controls for population density⁶¹, and for income using real provincial GDP per capita levels. Reported values have been deflated to year

⁶⁰ See Dewan and Riggins (2005) for a comprehensive review of the international literature.

⁶¹ Several authors highlight the importance of urbanization as a determinant of ICT penetration. Province level constructions of rural-urban ratios is not consistent across the years sampled here, and therefore urbanization is not adopted as a control. It is likely that urbanization affects penetration through the existence of economies of scale in infrastructure deployment. Population density may in fact be a better proxy for economies of scale.

2000 levels and are measured in units of 1000 RMB⁶². I control for education levels using as a proxy the share of the provincial population holding at least a junior college degree. Education is also proxied using levels of illiteracy, expressed as a percentage of the adult population. The inclusion of both these variables makes our estimates robust to the possibility that the effect of ICT diffusion is discontinuous across levels of education. Literacy is a basic hurdle on which the value of ICTs is conditional. Controlling for levels of higher education in the population is important as more educated citizens may be better able to influence government, irrespective of their ICT access. These proxies for education levels are also important as controls for the share of government expenditure devoted to education, as the marginal return to education spending is dependent on existing levels.

I introduce two controls for the extent of pre-existing telecom infrastructure. First, the National Bureau of Statistics reports the capacity of long-distance telephone exchanges, expressed in circuits. I transform this into a per capita measure, which measures the number of circuits per 100 provincial residents. Data is also available for the length of fibre optic cables in a province. Using provincial area as the denominator, I construct a measure of fibre optic cable density. These measures are thought to have geographical determinants. To control for the possibility that ICT diffusion is driven by the needs of local firms, I also control for the quality of the business climate by controlling for the number of domestic private firms per 1000 provincial residents.⁶³

⁶² As of January 1, 2000, 1USD = 6.14 RMB.

⁶³ These firms reflect the Chinese ownership category *siying qiye*. The prevalence of these firms is a good measure of the business climate since a large proportion of *de jure* private firms classified as legal person shareholding firms are, in fact, strongly affiliated with the state. Huang (2008) and Wang (2013) both adopt *siying qiye* as the ownership category which consists of unambiguously private firms.

Our dependent variables are likely affected by factors beyond ICT diffusion. While there is a declining marginal utility to citizens of new capital construction, and China is thought by some to have infrastructure levels befitting a middle or even high income country, conditions are highly variable across provinces. Where infrastructure levels are low, government spending on new capital investments may be welfare enhancing and thus indicative of responsiveness. I therefore control for infrastructure levels using the proxy of highway density, measured in length of highways in kilometres per kilometres squared. Provincial land area is also introduced as a control. Geographically larger provinces can be expected to spend more on capital construction to connect a dispersed population and ensure access to dispersed resources. The inclusion of population density is also relevant for the estimation of the share of government expenditure devoted to capital construction.

The share of government expenditure devoted to health and education can be expected to vary with demographic characteristics. I therefore include controls the share of the population who is elderly using the age dependency ratio of the provincial population, i.e., the ratio of people 65 and older to those of working age (15 to 64). The expectation is of a positive association between the share of expenditure devoted to health and the elder dependency ratio. Youth dependency, the ratio of provincial residents under 15 to those of working age, is also included as a control. The expectation is of a positive association between education's share of expenditure and the youth dependency ratio. Since education spending may also be responsive to current education levels in the population, the education-related controls discussed above are also relevant. The dependency ratios are obtained from the annual China Population Statistics Yearbook.

Finally, the optimal government spending mix from a social welfare perspective may vary with income levels (Mauro, 1998; Tanzi and Davoodi, 1998). Some have suggested that social spending may be higher where incomes are higher (Delavallade, 2006).

Provincial per capita GDP is therefore relevant as a determinant of both ICT diffusion and the composition of government spending. Inclusion of this covariate should also control for the greater capacity of citizens to bear the costs of health and education privately. This is important as private purchases have played a growing role in total spending on health and education in China (Zhang and Kanbur, 2005; Ngok, 2007).

Chinese provinces may have intrinsic characteristics which affect the composition of government spending or the rate of ICT diffusion but which are unobservable.

Fortunately, panel data have the virtue of enabling us to control for unobserved, time-invariant factors affecting our key variables. By estimating key parameters using within-province variation, we can deal with omitted variable bias that has time invariant sources (Cameron and Trivedi, 2005) by introducing province-level fixed effects, α_i . Nationwide policy shocks affecting the composition of government expenditure are controlled for through the inclusion of a year-specific fixed effect, δ_t . Note that land area is dropped as a control variable in those specifications which include fixed effects, as these models obtain estimates using within-province variation over time, and land area is time-invariant.

4.4 Estimation strategy

Estimates are derived from the following panel data regression model:

$$Y_{it} = \beta_0 + \beta_1 ICT_{it} + X'_{it} \beta_2 + \alpha_i + \delta_t + \mu_{it} \quad (2)$$

Where Y_{it} is government education, health or capital construction expenditure as a share of total government expenditure in province i , year t . Our variable of interest is ICT_{it} , which is a proxy for ICT access as described above. X'_{it} is a vector of province level covariates. α_i and δ_t are province and year fixed effects, respectively, and μ_{it} is a randomly distributed error term with a zero mean. Though no claim is made here that our variables of interest have been randomly assigned, the above model is nevertheless robust to the effect of observed covariates, intrinsic province-level characteristics and yearly, nation-wide shocks. Moreover, though none of the results presented below is considered by itself to demonstrate a conclusive causal relationship between ICT diffusion and government responsiveness, testing our hypotheses using various specifications, using both internet and mobile phone diffusion as independent variables, and employing a placebo test is claimed, in sum, to provide evidence that is highly suggestive of an underlying causal relationship.

5. Results

5.1 Descriptive statistics

By 2010, seven provinces had diffusion rates of over 50% (Beijing, Shanghai, Zhejiang, Guangdong, Fujian and Tianjin), whereas 12 provinces had diffusion rates of less than 30% (Heilongjiang, Ningxia, Tibet, Guangxi, Hunan, Henan, Gansu, Sichuan, Anhui, Yunnan, Guizhou and Jiangxi). By way of international comparison, Beijing's rate of internet diffusion in 2010 was equivalent to that in Lithuania, whereas Jiangxi's diffusion rate was equivalent to that in Syria. These results are presented in Table 3. As to mobile phones, by 2010, there were 65 mobile phone subscriptions per 100 residents at the national level. As can be seen by comparing the standard deviations reported in Table 4, as of 2010, there is still a greater degree of cross-sectional variation in mobile phone access than in internet access (10.77 versus 18.92). By 2010, there were over 90 mobile phone subscribers per 100 residents in four provinces (Beijing, Shanghai, Zhejiang and Guangdong), and less than 50 subscribers in six provinces (Yunnan, Guangxi, Anhui, Henan, Jiangxi and Sichuan). These data are presented in Table 5. A sense of the growing variation across provinces in internet and mobile phone penetration can be gleaned from Figure 3, above. Figure 6 presents a heat map of internet diffusion in 2010. Darker shades represent provinces with higher levels of internet diffusion.

Table 4. Internet diffusion rate by province, 2010

Province	Diffusion rate, %	Province	Diffusion rate, %
Beijing	62	Jilin	32
Shanghai	54	Hebei	31
Zhejiang	51	Inner Mongolia	30
Guangdong	51	Heilongjiang	29
Fujian	50	Ningxia	28
Tianjin	50	Tibet	27
Liaoning	44	Guangxi	27
Jiangsu	42	Hunan	27
Xinjiang	37	Henan	26
Shanxi	35	Gansu	26
Hainan	35	Sichuan	25
Shandong	35	Anhui	23
Shaanxi	35	Yunnan	22
Chongqing	34	Guizhou	22
Qinghai	33	Jiangxi	21
Hubei	33		
		<i>Total</i>	35

Source: National Bureau of Statistics, 2011.

Table 5. Summary Statistics for ICT Diffusion, 2010

Variable	Mean	St. dev.	Min.	Max.	Obs.
Internet penetration	34.71	10.77	21.29	62.08	31
Mobiles per 100 residents	65.09	18.92	20.69	108.55	31

Source: National Bureau of Statistics, 2011.

Table 6. Mobile phone subscription rate by province, 2010

Province	Mobile subscribers per 100 residents	Province	Mobile subscribers per 100 residents
Beijing	109	Shanxi	62
Shanghai	103	Hebei	61
Zhejiang	93	Hubei	60
Guangdong	92	Chongqing	58
Tianjin	84	Gansu	54
Inner Mongolia	82	Heilongjiang	54
Fujian	82	Tibet	52
Liaoning	76	Guizhou	52
Jiangsu	75	Hunan	50
Qinghai	71	Yunnan	49
Ningxia	69	Guangxi	48
Hainan	68	Anhui	47
Shaanxi	67	Henan	47
Jilin	66	Jiangxi	41
Shandong	65	Sichuan	21
Xinjiang	62		
		<i>Total</i>	65

Source: National Bureau of Statistics, 2011.

Figure 6. Heat map of internet penetration in Chinese provinces, 2010.



Note: Heat map of internet diffusion by province, 2010. Lighter shades represent lower levels of diffusion. Darker shades represent higher levels. The Hong Kong and Macau SARs are omitted, as is Taiwan.

5.2 Regression results

5.2.1 Internet diffusion

The effect of internet diffusion on the composition of government spending is reported in Table 7. Note that coefficients on the control variables discussed above are omitted from

Table 7 for the sake of convenience. As can be seen in Panel A, higher levels of ICT diffusion are, as hypothesized, associated with lower levels of capital spending. Column 1 presents pooled OLS estimates and includes the full set of controls described above, omitted here for ease of presentation. The coefficient of (-0.335) on internet diffusion indicates that for each ten percentage point increase in internet diffusion, approximately three percent less of government expenditure is devoted to capital infrastructure. As demonstrated in column (2), this effect is strengthened somewhat after the inclusion of province and year fixed effects (-0.362), and the statistical significance of the parameter estimate has increased to the one percent level. In column (4), I remove observations containing Tibet. This is the Chinese province with the largest land area, and which has devoted a great deal of expenditure to capital construction. Moreover, the infrastructure expansion seen in Tibet may in part reflect political priorities of the Chinese government. The pooled OLS estimate reported in this specification, (-0.373), is in fact higher than that in other specifications, and remains statistically significant at the five percent level.

Results reported in Panel B in Table 7 also support the hypothesis of an association between internet diffusion and government responsiveness. The pooled OLS estimate in column (1) (0.099) indicates that a ten percent increase in internet access is associated with a nearly a one percent increase in the share of government expenditure devoted to health. Fixed effects estimates are reported in column (2) and are largely unchanged (0.093), and are likewise statistically significant at the one percent level. In column (3), I drop controls for childhood and elderly dependency ratios. This data is not reported for the last year in our sample. Column (3) therefore includes the full sample of 310

province-year observations. The consistency of our results extends to this specification, and remains statistically significant at the one percent level.

The effects of internet diffusion on education spending are reported in Panel C of Table 7. The magnitude of the estimated effects is comparable to that found for health spending. The pooled OLS estimate of column (1) and the fixed effects estimate in column (2) (0.090) both indicate that a ten percent increase in internet access is associated with an increase in the share of government expenditure devoted to education of approximately one percent. The magnitude of this effect is reduced when dependency ratios are omitted, as in column (3), though the effect remains positive (0.062) and, as in all specifications, statistically significant at the one percent level.

Table 7. Impact of internet diffusion on composition of government spending,

China 2001-2010: Regression results

	(1)	(2)	(3)	(4)
<i>Panel A: Capital construction</i>				
Internet penetration	-0.335* (0.181)	-0.362***	-	-0.373** (0.177)
Includes controls	Yes	Yes	-	Yes
Includes fixed effects	No	Yes	-	No
Includes dependency ratios	Yes	Yes	-	
Includes Tibet	Yes	Yes	-	No
R^2	0.648	0.365	-	0.379
Constant	3.239 (3.390)	5.246 (7.650)	-	6.555 (7.259)
Observations	186	186	-	180
<i>Panel B: Health</i>				
Internet penetration	0.099*** (0.011)	0.093*** (0.010)	0.091*** (0.009)	-

Includes controls	Yes	Yes	Yes	-
Includes fixed effects	No	Yes	Yes	-
Includes dependency ratios	Yes	Yes	No	-
R^2	0.491	0.658	0.678	-
Constant	2.182*** (0.619)	4.054*** (0.897)	5.448*** (0.494)	-
Observations	279	279	310	-
<hr/>				
Panel C:	(1)	(2)	(3)	(4)
<i>Education</i>				
Internet penetration	0.098*** (0.026)	0.090*** (0.020)	0.062*** (0.023)	-
Includes controls	Yes	Yes	Yes	-
Includes fixed effects	No	Yes	Yes	-
Includes dependency ratios	Yes	Yes	No	-
R^2	0.397	0.303	0.214	-
Constant	12.047*** (1.501)	17.102*** (1.742)	16.293*** (0.909)	-
Observations	279	279	310	-

Notes: Standard errors in parentheses. Main independent variable in all panels is internet penetration in percentage terms. Dependent variable in Panel A is capital construction as share of provincial government spending. Dependent variable in Panel B is health spending as share of provincial government spending. Dependent variable in Panel C is education spending as share of provincial government spending. For each panel, column (1) pooled OLS regression estimates of the effect of a one percent rise in internet penetration on the dependent variable. Column (1) includes control variables, omitted for convenience. These are per capital income, education levels, telecom development, fibre optic cable density, physical infrastructure quality, population density, land area, private enterprises per capita, illiteracy levels, child and elderly dependency ratios. In addition to these controls, column (2) also includes province and year fixed effects. Data for capital construction ends in 2006. This limits observations in panel A to 186. Column (4) in panel A excludes Tibet from the analysis, further reducing the number of observations to 180. Data on child and elderly dependency ratios ends in 2009. This limits observations in columns (1) and (2) of Panels A and B to 279. In column (3), these controls are dropped from the analysis. This raises the number of observations to 310. Fixed effects are retained in column (3). For specifications including fixed effects, area is dropped as a control as this variable no longer includes variation. Models employing fixed effects estimated using within estimator. Standard errors are robust to cross-sectional heteroskedasticity and serial correlation within panel variable. R-squared therefore refers to proportion of within-province variation in columns (2) through (4). *, ** and *** indicate statistical significance at the 10, 5 and 1% levels, respectively. Details on construction and sources of all variables available in Appendix A.

5.2.2 Mobile phone diffusion

Table 8 reports estimates of the effects of mobile phone diffusion on government responsiveness. On the whole, the estimated effect of mobile phone diffusion on our variables of interest is smaller than that found using internet access, and the estimated magnitudes of this effect are more responsive to different specifications. In all specifications, however, the parameter estimates carry the expected sign. Were it not for the evidence cited above that mobile phone diffusion in China is more responsive to income than is internet diffusion, this would lead one to conclude that some of the effect attributed to internet access is, in fact, driven in some manner by an income effect. Our interpretation of the drivers of the weaker effect of mobile phone diffusion must be speculative, and I return to this question in the discussion.

Column (1) of Panel A of Table 8 reports pooled OLS estimates. A ten percent increase in mobile phone diffusion is associated with a 0.78 percent reduction in the share of government expenditure devoted to capital construction. The inclusion of province and year fixed effects in column (2) increases the estimated effect rather dramatically, to -0.231. In this, the full model, the effect is highly statistically significant, though in the other specifications this is not the case. The association between mobile phone diffusion and the share of expenditure devoted to health, reported in Panel B, is less sensitive to specifications. In the specification including fixed effects, column (2), a ten percent increase in mobile phone diffusion is associated with a 0.57 percent increase in $Health_Share_{it}$. Removing dependency ratios from the analysis does not dramatically alter the results. Estimates in all specifications are highly statistically significant. The share of government expenditure devoted to education is also positively associated with

mobile phone diffusion. The pooled OLS estimate in Panel C, column (1) indicates that a ten percent rise in mobile phone penetration is associated with a 0.32 percent increase in the share of expenditure devoted to education. Adding fixed effects as in column (2) doubles the magnitude of the observed effect. Removing child and elderly dependency ratios reduces the effect somewhat, though the coefficients in all specifications are of the expected sign and are statistically significant.

Table 8. Impact of mobile phone diffusion on composition of government spending,

China 2001-2010: Regression results

Panel A: <i>Capital construction</i>	(1)	(2)	(3)	(4)
Mobiles per 100 residents	-0.078 (0.054)	-0.231*** (0.056)		-0.215*** (0.051)
Includes controls	Yes	Yes	-	Yes
Includes fixed effects	No	Yes	-	No
Includes dependency ratios	Yes	Yes	-	Yes
Includes Tibet	Yes	Yes	-	No
R^2	0.645	0.405		0.412
Constant	3.815 (3.387)	8.011 (5.495)		8.428 (5.891)
Observations	186	186	-	180
Panel B: <i>Health</i>	(1)	(2)	(3)	(4)
Mobiles per 100 residents	0.051*** (0.008)	0.057*** (0.009)	0.055*** (0.007)	-
Includes controls	Yes	Yes	Yes	-
Includes fixed effects	No	Yes	Yes	-
Includes dependency ratios	Yes	Yes	No	-
R^2	0.430	0.608	0.643	-

Constant	1.731** (0.660)	3.232*** (1.078)	4.520*** (0.678)	-
Observations	279	279	310	-
<hr/>				
Panel C:	(1)	(2)	(3)	(4)
<i>Education</i>				
Mobiles per 100 residents	0.032* (0.018)	0.063*** (0.021)	0.044*** (0.013)	-
Includes controls	Yes	Yes	Yes	-
Includes fixed effects	No	Yes	Yes	-
Includes dependency ratios	Yes	Yes	No	-
R ²	0.373	.288	0.211	-
Constant	11.814*** (1.542)	16.096*** (1.474)	15.540*** (0.697)	-
Observations	279	279	310	-

Notes: Standard errors in parentheses. Main independent variable in all panels is mobile phone subscriptions per 100 residents. Dependent variable in Panel A is capital construction as share of provincial government spending. Dependent variable in Panel B is health spending as share of provincial government spending. Dependent variable in Panel C is education spending as share of provincial government spending. For each panel, column (1) pooled OLS regression estimates of the effect of a one percent rise in internet penetration on the dependent variable. Column (1) includes control variables, omitted for convenience. These are per capital income, education levels, telecom development, fibre optic cable density, physical infrastructure quality, population density, land area, private enterprises per capita, illiteracy levels, child and elderly dependency ratios. In addition to these controls, column (2) also includes province and year fixed effects. Data for capital construction ends in 2006. This limits observations in panel A to 186. Column (4) in panel A excludes Tibet from the analysis, further reducing the number of observations to 180. Data on child and elderly dependency ratios ends in 2009. This limits observations in columns (1) and (2) of Panels A and B to 279. In column (3), these controls are dropped from the analysis. This raises the number of observations to 310. Fixed effects are retained in column (3). For specifications including fixed effects, area is dropped as a control as this variable no longer includes variation. Models employing fixed effects estimated using within estimator. Standard errors are robust to cross-sectional heteroskedasticity and serial correlation within panel variable. R-squared therefore refers to proportion of within-province variation in columns (2) through (4). *, ** and *** indicate statistical significance at the 10, 5 and 1% levels, respectively. Details on construction and sources of all variables available in Appendix A.

5.2.3 Additional results

Table 9 reports results from placebo tests using consumption of print media as our variable of interest. In only one case is the estimated effect of increased print media circulation on government responsiveness statistically different from zero (the share of spending devoted to capital construction is negatively associated with print media diffusion when observations including Tibet are omitted), and the direction of the estimated effect on capital spending and education is sensitive to the specification employed. This increases our confidence in the relevance of our proposed mechanism, as print media consumption does not readily enable the collective action mechanism. Moreover, it increases our confidence that it is not citizen access to information per se which incentivizes government responsiveness, but citizen access to information which need not be delivered via government gatekeepers.

Table 9. Impact of newspaper and magazine circulation on composition of government spending, China 2001-2010: Regression results

Panel A: <i>Capital construction</i>	(1)	(2)	(3)	(4)
Print media	0.002 (0.040)	0.054 (0.036)		-0.108** (0.050)
Includes controls	Yes	Yes	-	Yes
Includes fixed effects	No	Yes	-	No
Includes dependency ratios	Yes	Yes	-	Yes
Includes Tibet	Yes	Yes	-	No
R^2	0.641	0.345		0.366
Constant	3.832 (3.410)	1.678 (6.806)		2.378 (7.326)

Observations	186	186	-	180
<hr/>				
Panel B: <i>Health</i>	(1)	(2)	(3)	(4)
Print media	0.009 (0.009)	0.002 (0.006)	0.000 (0.001)	-
Includes controls	Yes	Yes	Yes	-
Includes fixed effects	No	Yes	Yes	-
Includes dependency ratios	Yes	Yes	No	-
R^2	0.335	0.540	0.568	-
Constant	2.335*** (0.707)	4.758*** (0.983)	5.538*** (0.881)	-
Observations	279	279	310	-
<hr/>				
Panel C: <i>Education</i>	(1)	(2)	(3)	(4)
Print media	0.016 (0.020)	-0.016 (0.010)	-0.012 (0.012)	-
Includes controls	Yes	Yes	Yes	-
Includes fixed effects	No	Yes	Yes	-
Includes dependency ratios	Yes	Yes	No	-
R^2	0.367	0.247	0.179	-
Constant	12.218*** (1.538)	18.142*** (1.463)	16.580*** (0.832)	-
Observations	279	279	310	-

Notes: Standard errors in parentheses. Main independent variable in all panels is annual newspaper and magazine circulation per 100 residents. . Dependent variable in Panel A is capital construction as share of provincial government spending. Dependent variable in Panel B is health spending as share of provincial government spending. Dependent variable in Panel C is education spending as share of provincial government spending. For each panel, column (1) pooled OLS regression estimates of the effect of a one percent rise in internet penetration on the dependent variable. Column (1) includes control variables, omitted for convenience. These are per capital income, education levels, telecom development, fibre optic cable density, physical infrastructure quality, population density, land area, private enterprises per capita, illiteracy levels, child and elderly dependency ratios. In addition to these controls, column (2) also includes province and year fixed effects. Data for capital construction ends in 2006. This limits observations in panel A to 186. Column (4) in panel A excludes Tibet from the analysis, further reducing the number of observations to 180. Data on child and elderly dependency ratios ends in 2009. This limits observations in columns (1) and (2) of Panels A and B to 279. In column (3), these controls are dropped from the analysis. This raises the number of observations to 310. Fixed effects are retained in column (3). For specifications

including fixed effects, area is dropped as a control as this variable no longer includes variation. Models employing fixed effects estimated using within estimator. Standard errors are robust to cross-sectional heteroskedasticity and serial correlation within panel variable. R-squared therefore refers to proportion of within-province variation in columns (2) through (4). *, ** and *** indicate statistical significance at the 10, 5 and 1% levels, respectively. Details on construction and sources of all variables available in Appendix A.

The effects of OGI adoption on the composition of government spending are presented in Table 10. ICT diffusion, in the form of internet penetration, is added to the list of control variables included in the regression but omitted for convenience. “OGI adoption” is a dummy variable taking the value of one when either the province or a major city contained therein has, in a given year, adopted OGI legislation. In only one specification, relating to capital construction expenditure, is the association between OGI adoption and the composition of government spending statistically significant (column (1) in Panel A). After fixed effects are added to the regression, however, the effect of OGI adoption on capital expenditure disappears. In the case of expenditure on health, the coefficient on OGI adoption does not carry the expected sign, nor are the effects statistically significant. In the case of education expenditure, the sign of the effect is sensitive to model specification, and the effect is not statistically significant in either specification. Taken together, these results indicate that OGI adoption has no clear effects on government responsiveness as operationalized here.

Table 10. Impact of OGI adoption on composition of government spending,

China 2001-2010: Regression results

Panel A: <i>Capital construction</i>	(1)	(2)
OGI adoption	-1.725** (0.820)	-0.375 (0.590)
Includes controls	Yes	Yes
Includes fixed effects	No	Yes
Includes dependency ratios	Yes	Yes
Includes Tibet	Yes	Yes
R^2	0.656	0.367
Constant	4.162 (3.385)	5.364 (6.999)
Observations	186	186
Panel B: <i>Health</i>	(1)	(2)
OGI adoption	-0.092 (0.139)	-0.260* (0.140)
Includes controls	Yes	Yes
Includes fixed effects	No	Yes
Includes dependency ratios	Yes	Yes
R^2	0.492	0.663
Constant		3.933*** (1.063)
Observations	279	279
Panel C: <i>Education</i>	(1)	(2)
OGI adoption	-0.312 (0.336)	0.195 (0.285)
Includes controls	Yes	Yes
Includes fixed effects	No	Yes
Includes dependency ratios	Yes	Yes

R^2	0.399	0.305
Constant	12.293*** (1.524)	17.193*** (1.538)
Observations	279	279

Notes: Standard errors in parentheses. Main independent variable in all panels is a dummy variable taking the value of one when the province, or a major city within the province, has adopted OGI legislation. For complete list of adopting cities, see Table 1. Dependent variable in Panel A is capital construction as share of provincial government spending. Dependent variable in Panel B is health spending as share of provincial government spending. Dependent variable in Panel C is education spending as share of provincial government spending. For each panel, column (1) pooled OLS regression estimates of the effect of OGI adoption on the dependent variable. Column (1) includes control variables, omitted for convenience. These are internet diffusion, per capital income, education levels, telecom development, fibre optic cable density, physical infrastructure quality, population density, land area, private enterprises per capita, illiteracy levels, child and elderly dependency ratios. In addition to these controls, column (2) also includes province and year fixed effects. Data for capital construction ends in 2006. This limits observations in panel A to 186. For specifications including fixed effects, area is dropped as a control as this variable no longer includes variation. Models employing fixed effects estimated using within estimator. Standard errors are robust to cross-sectional heteroskedasticity and serial correlation within panel variable. R-squared therefore refers to proportion of within-province variation in column (2). *, ** and *** indicate statistical significance at the 10, 5 and 1% levels, respectively. Details on construction and sources of all variables available in Appendix A.

Though control variables are omitted from these regressions for convenience, one result in particular is worth noting. Increasing GDP is associated with a lower share of expenditure devoted to education. It may be that higher levels of GDP enable government to shift the education burden to the public and reduce its own expenditure. This result is significant for our estimation of the effects of ICT diffusion as it suggests that the effect of ICT diffusion on education's share of expenditure is not an artifact of an income effect.

6. *Discussion*

The non-random assignment of internet access across Chinese provinces presents challenges for causal inference as to the relationship between ICT diffusion and government responsiveness. Nevertheless, the weight of evidence presented in the previous section is compelling. Using three proxies of government responsiveness, I demonstrate a consistent and significant association with both internet and mobile phone penetration. Moreover, this finding is robust to a placebo test using traditional media as our independent variable. The effects are also of practical significance. Overall, we can conclude that governments are more responsive to citizens with better access to ICTs. In this section I present several important caveats to this conclusion, and then reconsider these results in light of the more general motivating questions of the present research.

Questions might be raised as to the solidity of the link between spending on education and health and public welfare. The data examined here do not permit us to disaggregate education and health spending so as to determine, for instance, the share of this expenditure devoted to teachers and health workers. In some countries, teachers form a powerful political constituency which is able to extract concessions from government in the form of above-market wages. Corruption in the distribution of these funds is also a concern. For instance, in a survey of Ugandan primary schools, Ablo and Reinikka (1998) found that between 1991 and 1995 only 30% of government expenditure per student had actually reached the schools. Some of this spending may take the form of the provision of above-market wages to civil servants, in which case the government could more properly be said to be responsive to these interests. That said, as noted by scholars of corruption, it is more difficult for state officials to extract rents from teacher and health

workers' salaries than from capital construction projects, and the latter is relatively favoured for its highly discretionary component.

As a final concern, given the difficulty of demonstrating an association between levels of schooling and development outcomes (Pritchett, 2001; Easterly, 2001, 73), one might question how well such spending serves the public interest. In the case of health care spending, a link between health care access and health outcomes is stubbornly difficult to demonstrate, both in cross-country studies and in randomized field experiments.⁶⁴

Moreover, the marginal return to health spending in terms of health outcomes is sensitive to the composition of health spending. The marginal benefit of USD 1 billion spent by a poor country on nutritional improvements, pre-and post natal care and eradicating communicable disease is far higher than if these funds were spent on advanced diagnostic equipment.

The estimates presented here for the effect of internet diffusion on responsiveness should be interpreted in light of the fact that many Chinese citizens access the internet through internet cafés. This could imply that the coefficient on internet diffusion is upwardly biased as those accessing the internet through cafés are contributing to the mechanisms which enhance responsiveness but are not counted in our measure. Moreover, it is only recently that customers at internet cafés have been forced to present government-sponsored IDs prior to using these services. The expected cost of sharing sensitive information may therefore have been lower for these users, who enjoyed a greater degree of anonymity than home subscribers. It also possible that this, in turn, contributes to the larger estimates for the effect of internet diffusion as opposed to mobile phone diffusion.

⁶⁴ For a review, see Hanson (2008).

Alternatively, the difference in estimates may imply that ICT diffusion impacts responsiveness not merely by reducing the cost of signalling intent to join collective actions, but also by reducing the cost to citizens of becoming better informed about the behaviour of government, the composition of government expenditure included. Government expenditures can be thought of as a good for which citizens, now better informed, exhibit an increased demand. Changes in individuals' subjective valuations of more responsive spending may be an important driver of the observed effects. The greater information content available online than through first generation mobile telephony may therefore account for the differences in the magnitudes of the observed effects of internet and mobile phone diffusion.

There are a number of possible interpretations of the reported absence of any effects of OGI adoption on the composition of government spending. Though in any quasi-experiment, individual or jurisdiction-level heterogeneity poses challenges for estimation and interpretation of treatment effects, in the case of OGI adoption we may not be justified even in assuming the application of the same treatment across all jurisdictions. That is, though OGI treatment is represented here by the inclusion of a dummy variable, there may be some heterogeneity in the nature of the treatment itself across provinces. This reflects China's ambiguous and fragmentary regulatory environment (Pearson, 2007), and the difficulty in implementing legislation at the level of citizen-state interaction. For instance, OGI regulations mandate the establishment of government websites from which information can be accessed by citizens. An informal survey of these websites by the author indicates variation in their functionality. Future research on the effects of OGI or e-government generally in China should attempt to operationalize

the quality of this portal, as the supposed transfer of information from government to citizens is dependent on the quality of this channel. A possible operationalization is the frequency with which a government web page is updated.

These findings have clear implications for the study of the information-responsiveness link, as they indicate that the association may obtain even in authoritarian state. Positing a collective action mechanism as an explanation for this finding challenges the position of “techno-pessimists”, who find that increasing ICT diffusion and television viewing are associated with an apparent reduction in the strength of the social bonds (Putnam, 1995; Sunstein, 2001; Olken 2009). These studies, however, consider the effects of ICT diffusion on bonds within groups traditionally viewed as having the potential for political mobilization under a given set of relative prices, the costs of sharing information and signalling intentions in particular. The implications of the profound lowering in the cost of sharing information and signalling intentions to millions of one’s fellow citizens should not be estimated only with reference to groups that are traditionally viewed as mobilizable, as these groups are those that were possible under old prices, and but a subset of those possible under new prices. By a similar logic, the reliance in the existing literature on the information-responsiveness link on electoral mechanisms may be too narrow. Even in democratic states, the focus of citizen energies on such formal processes is not exclusive, as the existence of lobby groups attests. The means of pressuring government to which citizens avail themselves reflect the underlying costs of these and alternatives. When technological developments lower the cost of some pathways for pressuring government, we can expect the importance of these pathways to increase.

Care must therefore be taken in how the question of the political implications of the Chinese internet is framed. Indeed, posited as a binary outcome (democratization/non-democratization), little headway can be made in assessing the impact of ICTs except in an ex post fashion. Though the prospects of more comprehensive political changes are not investigated here, given the room for further diffusion of ICTs throughout China we should not interpret the absence of collective action with dramatic political consequences as an indicator that reform is not more likely after the diffusion of ICTs. It is perhaps better to emphasize that by changing relative prices, ICT diffusion has opened mechanisms through which citizens can constrain government, and given the absence of formal mechanisms for so doing, this is in itself a promising development.

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Appendix A. Operational definitions and sources for key variables

Variables	Definitions	Sources
Capital share	Expenditure for capital construction as percent of government expenditure	China Statistical Yearbook (2002-2011)
Health share	Expenditure for public health as percent of government expenditure	China Statistical Yearbook (2002-2011)
Education share	Expenditure for operating expenses of education as percent of government expenditure	China Statistical Yearbook (2002-2011)
Internet diffusion	Internet subscribers as percent of provincial population	China Statistical Yearbook (2002-2011)
Mobile phone penetration	Mobile phone subscribers per 100 provincial residents	China Statistical Yearbook (2002-2011)
Print media	Newspapers and magazines consumed per 100 provincial residents	China Statistical Yearbook (2002-2011)
Per capita GDP	Provincial gross domestic product per capita, one thousand RMB, real year 2000 values.	China Statistical Yearbook (2002-2011)
Infrastructure	Highway density, i.e., km length of highways per km ²	China Statistical Yearbook (2002-2011)
Firms	Private enterprises per 1000 provincial residents	China Statistical Yearbook (2002-2011)
Population density	Population density, i.e., persons per km ²	China Statistical Yearbook (2002-2011)
Land area	Provincial land area, 1000 km ²	China Statistical Yearbook (2002-2011)
Telecom infrastructure	Telecom infrastructure, i.e., circuits per km ²	China Statistical Yearbook (2002-2011)
Fibre optic density	Fibre optic cable density, i.e., cable length in km per km ²	China Statistical Yearbook (2002-2011)
Illiteracy	Illiteracy rate of persons over 15	China Statistical Yearbook (2002-2011)
Education level	Percentage of provincial population with at least a junior college diploma	China Statistical Yearbook (2002-2011)
Elder dependency	Population 65 and over as percent of population aged 15-64	China Population Yearbook (2002-2010)
Youth dependency	Population 14 and under as percent of population aged 15-64	China Population Yearbook (2002-2010)

Notes: Province is level of analysis for all variables.

V. Conclusion

The new institutional economics (NIE), borne of a recognition of the rarity of costless exchange, has highlighted the economic relevance of institutions which can reduce the cost of transacting. The Northian strain in this literature emphasizes the role of the state which, given its comparative advantage in the employment of violence, is well-placed to shape the institutional rules under which economic agents transact. The state faces unavoidable trade-offs between growth-enhancing and stability-enhancing institutions (North, 1981), according to the logic which is explicated in North, Wallis and Weingast (2009). North has long viewed the location of the trade-off between these objectives as the primary determinant of macroeconomic performance over time (North, 1979, 1984), as states can be both the source of economic advancement or economic decline and stagnation. As such, the study of institutions is of particular relevance to scholars of developing countries (North, 1993) which have not made the transition from limited access orders - where states provide access to good institutions for elites only who, in return for the economic rents thereby generated, continue to support the regime - to open access orders, where states provide access to good institutions to all on an anonymous basis (North, Wallis and Weingast, 2009; Wallis, 2011).

Despite the theoretical advances represented by this literature and the empirical contributions noted in this dissertation's introduction, challenges to the Northian perspective remain. These might be categorized as problems of construct validity, empirical identification, and the substantive challenge of the applicability of this perspective to the rise of East Asia, China in particular. In the remainder of this

concluding chapter, I review the dissertation's contributions to the advancement of an NIE perspective on development in light of these challenges. I emphasize the usefulness of the study of firm behaviour as a barometer of institutional quality which has important economic impacts in the longer run. The findings reported in the dissertation have important policy implications for those hoping to improve the institutional setting in which firms do business, and these are also reviewed here. The potential for reducing the discretion of state agents through (i) central government policy intervention and (ii) the diffusion of technologies which reduce the cost of citizen access to information is also emphasized. I conclude with a consideration of outstanding challenges to empirical advances in the NIE of development, and a proposal for future research.

Operationalizing "good institutions" and identifying channels by which these can be shown empirically to affect particular forms of economic performance has proven a challenge for the NIE. In the spirit of Clague et al (1999), the dissertation's first paper presents an operationalization of institutional quality which is simultaneously objective and reflective of the incentives of state agents. As I argue in the introduction, the amount of discretion exercised by sub-national officials is also reflective of the divergence of their interests from those at the centre of the regime with a more encompassing interest in growth, and the amount of discretion exercised in practice is partly reflective of the cost of monitoring local officials as borne by the central government. The paper demonstrates that the relatively simple operationalization of discretion employed is predictive of the stock of domestic private enterprises in Chinese provinces. Discretion on the part of state agents in the imposition of administrative charges implies uncertainty about future burdens, and deters firm formation. Though the nature of the aggregate data employed in

this paper, and the non-random assignment of discretion levels to Chinese provinces, do not enable the ideal level of resolution to identify this mechanism at work, given the robustness of these findings to observed covariates and province and year fixed effects, at a minimum the findings are clearly consistent with the discretion-uncertainty link. This suggests that, as predicted by a Northian perspective, discretionary government regulation of business can be an important deterrent to private economic activity. From a policy perspective, it suggests that where limitations of the discretion available to local officials is politically feasible, significant economic benefits can be gained from the mitigation of this constraint on private economic activity. Interestingly, the policy reform discussed in the paper as a plausible explanation for the reduction in discretion as exercised by local officials, *shouzhi liangtiao xian*, relied on advances in information communication technologies (ICTs) as applied to government financial accounting. The success of policies like this implies that despite the political challenges, technological change can enable those with their hands on policy levers to bring the amount of discretion exercised by subordinates closer to their own optimal level.

These findings on the relevance of the exercise of government discretion to private economic actors should be interpreted in light of two somewhat contrary positions. Firstly, some have argued that heavy government intervention in Chinese firms has had beneficial effects (Che and Qian, 1998). Alternatively, Nee and Opper (2012) suggest that the institutions supporting the development of private enterprise in China do not derive from state policy, but have rather emerged from the choices of entrepreneurs themselves. These institutions are, in this view, privately supplied in the sense described by Ostrom (1990) and Shepsle (2006), and have enabled the relative flourishing of the

private sector in some parts of the country despite encouragement of the private sector not being a priority of the regime. The dissertation's first paper suggests, however, that while privately constructed institutions may have been important sources of uncertainty reduction of a type that matters to private firms, this does not imply that government policy is not a binding constraint on the choices of entrepreneurs. Rather, the paper demonstrates that marginal reductions in the discretion exercised by state actors has payoffs in terms of uncertainty reduction and, thus, firm formation.

Entrepreneurs being risk averse and facing uncertain returns, their choices are an interesting locus for assessing institutional quality. Though the first paper demonstrates the relevance of institutional quality for firm formation, it has several limitations which the second paper addresses. Firstly, the second paper employs firm-level data from a large, representative survey of Chinese industrial activity. As such, it has the virtue that the measurable institutional sources of uncertainty are clearly within the choice set of the investing firm. Findings based on this data are also robust to firm-level heterogeneity and we can be confident that our results do not derive merely from some form of composition bias, as may plague studies using aggregate data. Firm investment, moreover, being a continuous variable, is a more sensitive scale than entry and exit on which to assess the responsiveness of firm behaviour to institutional quality. Secondly, the firm level variation in the dataset employed in the second paper enables the identification of mechanisms or channels by which institutions (in this case, the perceived security of property rights) matter for investment. I present empirical evidence not only that perceived property rights security matters for investment, but that this association is mediated by a sunk cost mechanism, whereby investment by firms characterized by high

sunk costs is systematically more responsive to changes in the perceived security of property rights. Though we must rely on proxies for sunk costs to estimate this relationship, it generates clear predictions about firm investment choices which can be tested in other locales. Moreover, the existence of this mechanism implies a channel by which these firm-level choices shape the aggregate distribution of economic activity in developing states, as different levels of institutional quality imply differential survival rates of firms with high and low sunk costs. The sunk cost mechanism, then, may have an important role in accounting for the geographical clustering of firms in particular industries, a phenomenon well documented in the Chinese case (Long and Zhang, 2012).

The policy implications of ICT diffusion, briefly noted above, are taken up directly in the dissertation's third paper. An association between citizen access to information and government responsiveness has been well documented by papers relying on sub-national variation in information access. Most of this literature has investigated past information revolutions (i.e., radio (Stromberg, 2004; Francken et al, 2011) and newspapers (Besley and Burgess, 2002)). Though some recent papers have investigated the effect of internet diffusion on political participation (e.g., Miner, 2012), to my knowledge there have been no attempts to estimate empirically the effects of ICT diffusion on government responsiveness. Moreover, all studies of the information-responsiveness link have focused on democratic societies and tend to propose the electoral process as the channel by which information affects responsiveness. Qualitative evidence indicating that ICT diffusion in China has important political consequences has accumulated steadily over the last decade. The present work is among the first papers to evaluate the policy implications of China's internet empirically, and is to my knowledge the first to

demonstrate the existence of an information-responsiveness link in an authoritarian political system.

Though firm behaviour is not the focus of the dissertation's third paper, it shares with the others the reliance on sub-national differences to arrive at econometric estimates of the effects of interest. China's size, decentralized political economy and history of local policy experimentation in the reform years have created variation in policy and institutional quality that facilitate estimation using these techniques. With an eye to the limitations of this dissertation's findings and the outstanding challenges for an NIE approach to development more generally, I conclude this section with a discussion of future avenues for research that rely on this variation.

The non-random assignment of levels of institutional quality leaves estimates of the effect of institutions on economic performance vulnerable to omitted variable bias and endogeneity concerns. For instance, where enforcement of property rights is costly, it may be that relatively prosperous jurisdictions are better able to afford a higher level of effective property rights protection. Identifying the unique effects of a change in institutional quality on economic performance thus presents a challenge. Fortunately, China's decentralized political economy and large size enable more robust estimation using regression discontinuity designs to estimate border effects.

Holmes (1998) provides an example of the application of this approach to estimate policy effects. He assesses the effect of right-to-work laws on manufacturing's share of employment at borders between US states with and without such laws. The identification strategy is motivated by the theory that firms have an optimal location based on access to markets and relevant inputs. An alternative jurisdiction may have more attractive

policies, but moving to a different jurisdiction is costly. The firm will move to the alternative jurisdiction when the benefits of the attractive policy outweigh the costs of moving. Identification of the effects of policy on manufacturing's share of employment is accomplished by comparing the regions adjacent to the border between jurisdictions with and without the attractive policy. As one passes across jurisdictional borders, there is no discontinuous change in other factors affecting the attractiveness of a location, whereas there is an abrupt, discontinuous change in policy. Firms who wish to relocate to the jurisdiction with the attractive policy will, in an effort to minimize relocation costs, relocate to locations just across the border. That is, the only discontinuous change at the border that matters to firm location choice is the differing policy. The effect of the policy of interest can thus be estimated by comparing the jurisdictions adjacent to the border. If the policy has significant effects, a greater discontinuity in the outcome of interest will be found between sub-jurisdictions on either side of the border than between sub-jurisdictions more distant from the border. This research design takes advantage of the fact that on either side of the border, policy differences are random with respect to other covariates shaping ideal location choice.⁶⁵

China is an excellent candidate for the extension of these methods. Reflecting the decentralization of economic policymaking remarked on throughout this dissertation, a notable feature of China's development has been local policy experimentation. An important example of this experimentation has been the establishment of geographically

⁶⁵ Econometric estimates of border effects are derived using regression discontinuity techniques. For a comprehensive introduction, see Lee and Lemieux (2010).

delimited “special economic zones” (SEZs).⁶⁶ The zones were defined by a set of laws operating within, but not without, the adopting jurisdictions. These include laws governing taxation, labour, export and import credits, and access to foreign investment. The goal, broadly speaking, was to establish conditions conducive to the expansion of private economic activity.

The geography of the zones is important from an identification perspective, as it allows us to use a border effects model similar to that employed by Holmes (1998). If the zones are effective in achieving their aims, we would expect abrupt discontinuities in variables of interest at the border. Discontinuities between sub-jurisdictions on either side of the border should be larger than those between sub-jurisdictions more distant from the border. It is also of interest that there is considerable variety in the policy packages implied by individual zones. Three broad types of questions can thus be investigated using border discontinuities. Firstly, this analysis enables a significant contribution to a debate on the relative importance of geography and institutions to China’s development.⁶⁷ Discontinuous border effects in the outcomes of interest cannot be accounted for by geography, and a demonstration of their presence would indicate the relevance of policy in shaping outcomes of interest. Secondly, the relative importance of particular policy features can be identified by comparing the magnitude of discontinuities in variables of interest at borders with a policy discontinuity in, for instance, labour law, with that at borders with a discontinuity in access to foreign investment. Thirdly, the initial SEZs established in China’s south represented large marginal changes in the policy

⁶⁶ On the history of Chinese SEZs, see, among others, Xu (2011), Zeng (2011) and Yeung, Lee and Kee (2009). Recent empirical work on the economic impact of SEZs includes Alder, Shao and Zilibotti (2012) and Wang (2013).

⁶⁷ For the geography-centric perspective, see Bao et al (2002) .

environment faced by economic actors in these zones. Subsequent years have seen the proliferation of these zones and a broad improvement of economic conditions. An additional question of interest, then, is whether the establishment of zones in more recent years still represent marginal improvements in the policy environment sufficient to affect firm behaviour.

Estimation of these border effects would rely on data generated by China's Economic Census. Censuses were undertaken in 2004 and 2008, and a third census is currently underway. These censuses enumerate all economic units throughout the country, identifying enterprises/firms by their registration status, employment levels, revenue levels, year in which operations began, industry and, crucially, postal code.

Enumerations of SEZs, subdivided by the implied policy package, have been undertaken by Wang (2013). However, to date no scholars have taken advantage of the geographical features of the SEZ phenomenon to estimate border effects using a regression discontinuity design. Such a project would rise to several challenges which plague the NIE literature, and which have motivated the present dissertation. Namely, on the basis of the assumption that non-policy variables do not change abruptly at borders, it would enable the unbiased estimation of the effect of the policy packages enacted in the SEZ on important features of firm behaviour.⁶⁸ This would be of interest to those working within the NIE tradition, and of direct policy relevance to policymakers in developing states, particularly as the political challenges of reform are more easily met when implementation of these reforms is geographically delimited.

⁶⁸ Naturally, these discontinuities measure all discontinuous border effects. The validity of the regression discontinuity approach requires the assumption that confounding factors do not also change abruptly at the border.

The NIE has provided a framework for understanding the institutions which shape transaction costs in developing countries, and an empirical NIE research paradigm has evolved which has attempted to estimate the effect of institutions on economic performance. This dissertation has been motivated by the broader theoretical perspective of Northian institutionalism, and has sought to contribute to our empirical understanding of the effect of institutions on policy relevant outcomes using modern econometric techniques. The theoretical orientation denotes a recognition that existing institutions reflect the incentives of those in a position to shape them. Beyond the empirical challenges of arriving at robust estimates of the effect of institutions on economic performance, policy reform also implies political challenges. Nevertheless, despite its concern with less obviously political questions, the empirical literature of which this dissertation is a part is relevant to the political challenges faced by reformers. Econometric studies can help identify, following the advice of Rodrik (2006), those institutions which represent the most binding constraints on economic activity. In so doing, they identify substantive policy areas on which the attention of reformers should be focused.

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