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Wendy Carlin, Mark E Schaffer and Paul Seabright

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# SOVIET POWER PLUS ELECTRIFICATION: WHAT IS THE LONG-RUN LEGACY OF COMMUNISM?

**Wendy Carlin, University College London and CEPR**
**Mark E Schaffer, Heriot-Watt University and CEPR**
**Paul Seabright, Toulouse School of Economics and CEPR**

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Centre for Economic Policy Research
77 Bastwick Street, London EC1V 3PZ, UK
Tel: (44 20) 7183 8801, Fax: (44 20) 7183 8820
Email: cepr@cepr.org, Website: www.cepr.org

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## ABSTRACT

# Soviet power plus electrification: what is the long-run legacy of communism?*

Two decades after the end of central planning, we investigate the extent to which the advantages bequeathed by planning in terms of high investment in physical infrastructure and human capital compensated for the costs in allocative inefficiency and weak incentives for innovation. We assemble and analyse three separate types of evidence. First, we find that countries that were initially relatively poor prior to planning benefited more, as measured by long-run GDP per capita levels, from infrastructure and human capital than they suffered from weak market incentives. For initially relatively rich countries the opposite is true. Second, using various measures of physical stocks of infrastructure and human capital we show that at the end of planning, transition countries had substantially different endowments from their contemporaneous non-transition counterparts. However, these differences were much more important for poor than for rich countries. Finally, we use firm-level data to measure the cost of a wide range of constraints on firm performance, and we show that after more than a decade of transition in 2002-05, poor transition economies differed much more from their non-transition counterparts, in respect to both good and bad aspects of the planning legacy, than do relatively rich transition countries. However, the persistent beneficial legacy effects disappeared under the pressure of strong growth in transition economies in the run-up to the global financial crisis.

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Wendy Carlin
Department of Economics
University College London
Gower Street
London
WC1E 6BT

Email: w.carlin@ucl.ac.uk

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Mark E Schaffer
Centre for Economic Reform and Transformation, Dept of Economics
Heriot-Watt University
Riccarton
Edinburgh
EH14 4AS
Email: m.e.schaffer@hw.ac.uk

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Paul Seabright
Institut d'Economie Industrielle
Toulouse School of Economics
Manufacture de Tabacs
21, Allée de Brienne
31000 Toulouse
FRANCE

Email: paul.seabright@tse-fr.eu

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## 1. Introduction

"Communism is government by the Soviets plus the electrification of the whole land.... Only when the economy has been electrified and modern heavy industry has become the technical basis of industry, agriculture and transportation, only then will we succeed at last."
(V.I. Lenin, 1920)

This paper examines the effects of exposure to Soviet-style planning on long-run economic development. We use two benchmarks to view the outcome of the large-scale planning experiment in the 20th century. In the first, we compare countries that were similar before planning was imposed. How did the countries exposed to planning fare in terms of long-run development as compared with countries that were at similar levels of development when planning began? In the second comparison, we take countries at similar levels of GDP per capita when planning ended and ask whether planning left countries different from their peers in ways that were likely to be important for their future development. The first perspective sheds light on the overall development trajectory due to planning and the second on particular qualitative features bequeathed to the countries that underwent the experience of planning.

Hypotheses about the impact of planning on development have a long history. Restricting attention to Soviet-style planning, they run from the lengthy debate in the 1930s on the merits of planning versus the market, through the evidence that accumulated in the sub-field of comparative economics in the post-war years to more recent evidence on the role of market institutions such as competition in growth. We focus on two of the core ideas that emerge from these literatures. The first is that planning is detrimental to long-run economic growth partly because of the wide range of static allocative inefficiencies resulting from planning failures, and partly because planning inhibits the adoption of higher productivity technologies and prevents the closure of low productivity enterprises and activities. Interference with the Schumpeterian processes of creative destruction by switching off both the incentive for enterprises to move a step ahead of the competition, and the threat of bankruptcy, weakens productivity growth. Market institutions external to firms, such as the rule of law, the control of corruption, a stable macroeconomic environment and the efficient administration of taxes, licenses and customs have been identified as important in enabling the benefits of "the market" to be reaped.

The second thesis linking planning to development is that a symptom of the interference by planners in market processes was the priority given by them to investment in physical infrastructure and education. Adopting planning early in the process of industrialisation could generate rapid development and growth, and is the standard explanation for why the USSR grew rapidly in the 40 years after the adoption of the Stalinist planning system in 1928. Even in mature, industrialised economies, planning could be growth-promoting to the extent that market failures in capitalist market economies can prevent the adequate supply of public infrastructure and education. Since Soviet planning overrode some of the weaknesses of market systems as well as some of their strengths, an overall evaluation of the legacy of planning is likely to be complex, involving a trade-off between these two types of effect. The fact that the ideological fervour with which these questions were once debated has been diminishing as the Soviet Union recedes into history

means that it is becoming easier than it used to be to approach the overall evaluation in a comparatively dispassionate frame of mind.

Recent historical research has already shed important light on the impact of planning on the growth of the countries that experienced it. Good and Ma (1999) construct a consistent series of per capita GDP from 1870 to 1989 for the present day states of Central and Eastern Europe. They use this to compare the performance of the states in this region with those of the rest of Europe. Their overall conclusion is that there is "no systematic difference in growth rates between Central and Eastern Europe and the rest of Europe" (p. 114). One qualification is the period 1870-1910, prior to planning, "when growth tended to be about 0.2 percentage points faster in the region". A second is the period 1973-1989, "when growth was around 0.7 percentage points slower in the region". Overall, the implication is that planning did not make a clear difference overall to growth, at least until the period after 1973. What we do in the present paper is to show that this conclusion conceals an important difference between the countries concerned. Initially poor countries benefited from planning; initially more prosperous countries suffered from it[1].

Crafts and Toniolo (2010), taking the analysis up until 2005, have a slightly more negative verdict on planning, noting that even if in the period from 1950-1973 "communism delivered growth rates only a little below those in Western Europe…this is not so impressive once the much greater scope for catch-up is taken into account"(p. 300). Chief among the reasons they cite for this discrepancy is that "the planning system rewarded managers who achieved production targets in the short term rather than those who found ways to reduce costs or improve the quality of output over the long term" (p. 315). More specifically, "the incentive structures used by the Soviet leadership to motivate managers and workers were a complex mixture of rewards, punishments and monitoring. Each of these became increasingly expensive over time, with the consequence that the viability of the system was threatened" (p.323).

Broadberry and Klein (2011) use a detailed sectoral comparison of labor productivity between the UK and Czechoslovakia to cast light on why central planning was more successful at some tasks than at others. In particular they conclude that "central planning was able to achieve a satisfactory productivity performance during the era of mass production, but could not adapt to the requirements of flexible production technology during the 1980s" (p.37). This suggests an important reason why the impact of planning should not be expected to be the same for countries at all levels of initial development. The results we show in this paper are entirely consistent with Broadberry and Klein's evidence about the source of planning's disadvantages; in addition we show that the source of planning's advantages lay principally in its emphasis on infrastructure and human capital.

Our analysis takes place in three steps. First, we use cross-country data on long-run performance to see whether the detrimental effects of the loss of market incentives when planning was imposed outweighed the potentially beneficial effects of interference in the market allocation through forced investments in physical infrastructure and education. Contrary to the view that planning was universally detrimental to development, we find that

[1] Good and Ma do consider the relevance of initial levels of income, but the impact they examine is directly on the growth of GDP per capita. They do not consider the relevance of initial levels of income on the *impact* of planning on growth. See below.

countries that were initially poor when they adopted planning did no worse and probably somewhat better by the end of the central planning era than their pre-planning peers. The countries that were relatively rich when planning was introduced, on the other hand, had levels of GDP per capita at the end of planning that were no better and probably somewhat worse compared to their pre-planning peers. In short, against the background of widely varying outcomes for market economies over this period, planning appears not to have worsened outcomes across the board. It may have improved them for the countries which industrialised under planning, but it made them worse for the countries which had already started or completed industrialising before planning began.

Whereas the first set of comparisons are made in terms of GDP per capita at the start and the end of planning, in the second step we compare aggregate measures of infrastructure and institutions in transition economies with their contemporary GDP per capita peers. Our 1988 snapshot tests the prediction that planning left these countries with higher levels of both physical infrastructure and education than was the case in countries at similar levels of GDP per capita. A follow-up snapshot, in 2008, provides evidence on whether differences survived well into the transition period, and also provides evidence on the institutional legacy of planning. The aggregate indicators show that the relative over-endowment of planned economies in education and physical infrastructure still persists 20 years after planning ended, particularly for the poorer countries. We also find that the legacy of weak market economy institutions persists.

Although the aggregate indicators of infrastructure and institutions provide useful information, they suffer from serious problems. First, they do not provide an accurate measure of the flow of services from the external environment to firms. Indicators of institutional quality are particularly noisy in this regard. Second, even if we can reliably distinguish the quality of such institutions as the rule of law in one country from that in another, this does not say anything about whether problems with the rule of law are more or less pressing for firms than are problems with, say, electricity. To understand whether the constraints on development left by planning were more or less important than the constraints faced by other countries, we need a different methodology.

This takes us to the third part of our analysis, where we show how firm-level survey data can be used to assess the impact of infrastructure, education and market institutions on firm growth. We apply the methods developed in Carlin et al. (2006, 2010) to the comparison between transition and non-transition countries. We show how firm-level data can provide evidence on the comparative seriousness of inadequacies in a wide range of elements of the firm's physical and institutional environment. With these methods it is possible to go beyond quantitative differences in the indicators of infrastructure and institutions that are viewed as important for productivity growth. The question is not just whether there is more or less electricity or corruption in formerly planned versus market economies at similar levels of development, but how large is the impact of these elements of the external environment on firm growth. We compare the impact of both physical infrastructure and education – capturing the "forced development hypothesis" – and of market institutions across a large sample of transition and non-transition economies. The survey data allow us to evaluate the persistence of legacy effects in the second decade of transition and again after the phase of rapid growth prior to the global financial crisis.

## 2. Planning versus the market: what do the long-run data show?

A longstanding theme in the analysis of centrally-planned economies is that of "static efficiency" versus "dynamic efficiency". The latter term, in this context, refers to growth and the rate of technological change. The Soviet Union, in this perspective, suffered from large static inefficiencies deriving from the many allocative failures of central planning, but nevertheless could – and initially did – grow quickly because central planning was an effective mechanism for achieving high rates of capital accumulation and the absorption of new technologies.

A more modern version of this theme is to place the long-run growth of centrally planned economies in the context of technological catching-up. A poor country that adopted central planning could initially grow rapidly because of rapid industrialisation and high rates of investment in human and physical capital and infrastructure. Eventually, however, growth slows down because of catching up and because capital stops growing faster than output. At this point, the static inefficiencies inherent in central planning dominate, and the country reaches an equilibrium productivity gap vis-à-vis the developed market economies.[2]

In this perspective, the legacy of central planning depends on where a country was in the industrialisation or catching-up process at the time it adopted planning, and on the counterfactual – what would have happened had the country not adopted planning? For countries that were already relatively rich and largely industrialised at the time central planning was adopted, the natural counterfactual is that they would have continued to be members of the developed-economy convergence club. The benefits to these countries of high rates of investment in human capital and physical infrastructure would have been relatively limited, and the costs of the allocative inefficiencies of central planning substantial. Similarly, in the post-planning transition era, the costs to these countries of inheriting poor economic institutions would be expected to be substantial.

On the other hand, for countries that were very poor and essentially pre-industrial at the time planning was imposed, the counterfactual is not obvious. These countries might have industrialised anyway, or they might have remained members of the poor-country (non-) convergence club. Under the first counterfactual, the legacy of central planning would have been very costly, just as it was for the relatively rich countries that adopted planning. Under the second counterfactual, the legacy of central planning could actually be beneficial, where the industrialisation under central planning is not reversed after its removal, and where the poor quality institutions inherited from the planning era ought to be compared to the similarly-poor quality institutions under the counterfactual scenario where the country failed to start sustained catching-up. One way to see which of these two counterfactuals is more likely is to compare the outcomes for countries that adopted planning with those for non-planned countries that had initially similar levels of development. This exercise essentially assumes that we can find an overall group of countries for which the adoption of planning was not systematically related to the factors, both observed and unobserved, that determined its overall aptitude for long-run development. This is the exercise we report in this section.

Countries at widely different levels of development adopted Soviet-style planning at two points in the 20th century. The first group consists of the early adopters: what were then

[2] The papers by Gomulka (1986) and Gomulka (1988) set out these arguments.

the 11 constituent republics of the Soviet Union when the basic structures of central planning were introduced by Stalin in 1928. The second group of late adopters were countries in Eastern Europe (including 4 countries that were also formally incorporated into the Soviet Union), where socialist planning was imported or imposed in the late 1940s following the Second World War. Because of the disruptions of the two world wars, we choose 1913 and 1937 as our pre-planning comparison years for the early and late adopters, respectively.

Both groups of countries were quite heterogeneous in terms of level of development prior to the adoption of planning. The group of early adopters includes countries such as Russia where industrialisation had already started, and the Central Asian countries, which were extremely poor and essentially still pre-industrial agricultural/nomadic societies. The late adopters were more heterogeneous still, ranging from the industrialised Czech Republic (then part of Czechoslovakia) to very poor and still agricultural Balkan countries.

We use long-run cross-country data on GDP per capita to examine both the effect of exposure to planning and its abandonment on comparative development. Our data for 1913 and 1937 derive from Maddison (2009) and are presented in Tables 1a and 1b. Maddison's estimates do not disaggregate the then Russian Empire, USSR, Yugoslavia or Czechoslovakia,[3] so our figures for the initial years include a large number of estimates; full details are in Appendix Notes A1. The general picture and results, however, are not very sensitive to the assumptions used.

We use two sets of comparator countries that did not adopt planning. The first, larger set includes all countries in Maddison's data-base in the base year (1913 or 1937) with a level of GDP that is no higher than 20% above that of the richest country in the group that adopted planning (in 1913, Russia; in 1937, Estonia and Latvia). The second set is a subset of the first and its composition is motivated by the geographical patterns in convergence clubs: we include only countries in Europe and Western, Central and Southern Asia (EWCSA).

The results are presented in two sets of scatterplots, one for the early adopters and one for the late adopters (Figure 1). In all cases, the horizontal axis is log GDP per capita in the base year (1913 or 1937). The vertical axis is the outcome – the level of development, proxied by GDP per capita – at the very end of the planning era, in 1988, and also after nearly two decades of transition, in 2008. Countries that adopted planning are in red upper-case letters; comparator EWCSA countries are in blue upper-case letters; and comparator countries from elsewhere in the world are in blue lower-case letters. The scatterplots include regression lines corresponding to the three country samples (countries that experienced planning, all comparators, and EWCSA comparators only).

The scatterplots clearly suggest the legacy of planning is quite different for the countries that were relatively poor when planning was adopted as compared with those that were relatively rich when planning was adopted. By 1988, the very poorest adopters of planning were as rich, or richer, than the countries that had similar levels of income in 1913 and 1937. The richest adopters of planning, by contrast, were no better off, or poorer, than their comparators. This pattern did not disappear with the abandonment of planning: it is still apparent in the levels of income of transition countries and their comparators in 2008.

[3] Though Broadberry and Klein (2008) do provide a separate estimate for Russia in 1913 which we make use of; see Appendix Notes A1

A more formal, statistical test of this pattern can be done by estimating a simple linear regression:

$$\ln(\boldsymbol{GDP}_{t2}) = \beta_0 + \beta_1 \boldsymbol{TE}_i + \beta_2 \ln(\boldsymbol{GDP}_{t1}) + \beta_3 \left[\boldsymbol{TE}_i * \ln(\boldsymbol{GDP}_{t1})\right] + \boldsymbol{e}_i, \quad (1)$$

where $TE_i$ is a dummy variable and *t1* and *t2* refer to the initial reference year and the end year, respectively. The key difference between this formulation and that reported by Good and Ma (1999) is the inclusion of the interaction term $\beta_3 \left[\boldsymbol{TE}_i * \ln(\boldsymbol{GDP}_{t1})\right]$. Good and Ma are concerned with the differential growth performance between the countries of Central and Eastern Europe and their comparator countries, and they employ a specification with a catching-up effect common to planned and market economies; in our equation (1) above, this is equivalent to focusing on $\beta_1$ and assuming $\beta_3 = 0$. Our more general specification in effect allows for a wider range of possibilities: for instance, poor countries with central planning could initially grow more quickly than similarly poor market economies (converge in income towards the developed market economies), and at the same time richer (less poor) planned countries could grow more slowly than their market economy comparators.[4]

Equation (1) is estimated using OLS with heteroskedastic-robust standard errors and is then used to test the difference in TE vs. NTE log GDP per capita in period *t2* for a range of values $\boldsymbol{Y}$ of initial GDP per capita, i.e., $\hat{\beta}_0 + \hat{\beta}_3 \boldsymbol{Y}$. The results are shown in Table 2a. The values $\boldsymbol{Y}$ at which the difference is tested correspond to the lowest and highest observed incomes among the countries that would adopt planning: $925 and $2,125 per capita in 1913, and $1,200 and $4,750 in 1937. The table shows that in 1988, the poorest countries that adopted planning had, on average, incomes that were 53-102% higher (in log percentage points) than their comparators, depending on the composition of the comparison (early or late adopters, all comparators or just EWCSA countries); three of these four comparisons are statistically significant. The four comparisons involving the richer adopters show that their incomes in 1988 were, on average, 14-57% lower than their comparators; two of these comparisons are statistically significant. By 2008, the gap for the poorest adopters had decreased, but the gap for the richest adopters had increased.

While Table 2a compares transition against non-transition countries at two different levels of development, Table 2b reports the results of the linear regression to show that the level of development was a significant determinant of the impact of planning. The estimated $\hat{\beta}_3$, the coefficient on the interaction term $\left[\boldsymbol{TE}_i * \ln(\boldsymbol{GDP}_{t1})\right]$, is negative in all eight estimations and significantly different from zero in six, suggesting our more general specification is warranted. The finding that $\hat{\beta}_3 < 0$ is evidence that the effect of central planning was significantly more negative the richer the country was before planning was imposed.

[4] More precisely, Good and Ma estimate a model where the dependent variable is the rate of growth and the explanatory variables include a regional dummy for Central and Eastern Europe (their focus) and a measure of the productivity gap between the country and the technological leader (taken to be the US). Because all the observations in our estimations share a common starting year, our use of the level of GDP per capita in the initial year corresponds to the measure of the productivity gap in their formulation. Other differences are that Good and Ma consider a narrower range of counties – Central and Eastern Europe vs. other European countries – and a wider range of time periods, including those prior to the planning experience.

In sum: initially poor countries ended planning no worse off, and if anything, better off, than their pre-planning peers; but any advantage was less visible in 2008, after the planning collapse and the partial and unevenly spread recovery. Initially rich countries ended planning no better off, and if anything, worse off, than their pre-planning peers; and this disadvantage was still more visible in 2008.

This pattern is consistent with the view that central planning could generate rapid growth in initially poor and unindustrialised countries via the rapid mobilisation of resources and high rates of investment in physical and human capital and public infrastructure. When planning was abandoned, poorer countries should therefore have been relatively well-endowed with physical infrastructure and human capital compared to market economies with similar incomes. In the already-industrialised, richer countries that adopted planning, the additional mobilisation of resources had fewer payoffs. The legacy of weak institutions would therefore have weighed more heavily on these richer countries.

In the next section we consider the aggregate evidence from 1988 and 2008 for the existence of legacies of physical and human capital, public infrastructure, and economic institutions in the planned economies.

**3. The long shadow of communism: how normal were the planned economies?**

In this section we compare the level of physical infrastructure and human capital, and the quality of a range of public inputs and market institutions believed to be important for the growth of firms, between transition and non-transition economies at the end of the planning period and in the second decade of transition. Relative to their GDP per capita peers that had not experienced planning, did the decades with non-market allocations affect the quality of market institutions after more than a decade and a half of transition? This set of cross-country comparisons helps clarify whether planning left traces of the kind suggested by the hypothesis of forced investment, how long they lasted and how quickly deficits in market institutions were overcome.

We present scatterplots of public inputs in transition and non-transition economies against GDP per capita, and again fit simple linear regressions to these data using OLS. We estimate the gaps at a low and high level of GDP per capita, defined as, respectively, the level of the poorest TE country in the sample, and at the level of the richest TE country in the sample, from a simple cross-country equation of the form:

$$\overline{\boldsymbol{B}}_j = \beta_0 + \beta_1 \boldsymbol{TE}_i + \beta_2 \ln(\boldsymbol{GDP}_i) + \beta_3 \left[\boldsymbol{TE}_i * \ln(\boldsymbol{GDP}_i)\right] + \boldsymbol{e}_i, \quad (2)$$

where $\overline{B}_j$ is a measure of the public input in country *j*.

For physical infrastructure and education, quantitative indicators are available as proxy measures of the supply of public inputs at country level at the outset of transition. In Fig. 2 we compare the endowments of physical infrastructure and enrolment in secondary education in the former planned economies and market economies when communism collapsed. The indicators are electricity generation, railway track, telephone mainlines, and secondary school enrolment (% of cohort). Comparisons between transition and non-transition countries are reported in Table 3 for a low and high level of GDP per capita. In all cases the provision in poor planned economies in 1988 was higher than was the case for non-transition economies. These endowments of physical and human capital persisted from the

planning era into transition in the poorer countries: in 2008, the poorer transition economies had substantially more of all four types of inputs than their market economy comparators. The richer planned economies, however, were less well-endowed vs. their market comparators: in 1988, more railway lines and modestly more human capital, but no more electricity generation capacity and fewer telephone lines; and by 2008, if anything, less human capital than their market economy comparators.

In short, according to the aggregate indicator data, formerly planned economies, especially poor ones where industrialization took place under planning, entered transition with higher levels of physical infrastructure and human capital than was characteristic of market economies at a similar level of development. To the extent that GDP per capita was overstated in the planned economies, these positive infrastructure endowment gaps were even larger.

Although there is an extensive literature describing shortcomings in market-economy institutions at the outset of transition (e.g. Roland, 2000, Svejnar, 2002), quantitative indicators of gaps in institutional inputs are more difficult to find. There are a number of country-level proxy indicators of the business environment, each with a somewhat different focus. Examples that have been widely used in the economics and political science literature are the World Bank's World Governance and Doing Business indicators, and the Economic Freedom indicators produced by the Heritage Foundation and by the Fraser Institute. Appendix Table A1 summarizes the nature of the data sources used and the methods by which these four different sets of aggregate indicators are compiled.

To illustrate the nature of the data, we provide examples in Figures 3a and 3b. The first example shows each constituent element of the World Bank's Doing Business indicator for 2010. The data are presented in the same way as for the elements of physical infrastructure and human capital in Fig. 2. Although the relationships in Fig. 3a are positively sloped with higher standards of the business environment recorded in richer countries, it is immediately obvious that the associations are far looser than was the case for the physical infrastructure and human capital indicators. No clear difference between transition and non transition economies jumps out from the scatter plots. The same noisiness is displayed by the data for the indicators from the other three sources (not shown).

The second example (Fig. 3b) takes two aspects of the business environment (trade and corruption) and compares the results for the three sources where data for the particular aspect are reported. World Bank Governance, Heritage and Fraser produce a rating of the business environment related to corruption (bottom row of charts in Fig. 3b). Although the results are very noisy, the patterns are consistent across indicators: transition economies score more poorly than do non-transition ones at similar levels of GDP per capita. Unfortunately, inconsistencies across indicators are also common. Doing Business, Heritage and Fraser all report an indicator related to trade (Fig. 3b upper row of charts). Higher GDP per capita is associated with a better score on the indicator in each case. However, unlike the corruption example, different indicators of the environment for engaging in trade point in different directions regarding comparisons between transition and non-transition economies. When comparing transition and non-transition economies, the Fraser indicator shows no difference; the Doing Business indicator suggests that the environment for international trade is less

good in poor transition countries than in poor countries outside transition; and the Heritage index suggests the opposite.

To summarise: the poor TEs look much better endowed with physical infrastructure and human capital than poor NTEs at the end of planning, and this difference has persisted quantitatively as well as qualitatively through 2008. The difference in endowment in the richer countries that experienced planning was smaller at the end of planning vs. their market economy comparators, and smaller still by 2008. The picture with respect to market institutions is much less clear, in large part because the indicators are noisy and sometimes inconsistent.

In the next section we turn to the final step in our analysis. We consider further the problems with using aggregate measures of infrastructure and institutions in trying to assess the legacy of planning, and present an alternative strategy based on firm-level survey data on the business environment.

## 4. Measuring the impact of the external environment on firms using firm-level survey data

Although the aggregate indicators of infrastructure and institutions presented in Section 3 are suggestive of persistent legacy effects of planning, they do not provide an accurate measure of the flow of services from the external environment to firms and they provide no information about the relative importance of constraints on growth according to whether an economy had been exposed to planning. Both of these shortcomings are especially troubling in interpreting the post-communist experience. For example, it is clear from Fig. 2 that railway networks throughout the transition period were very extensive in the former planned economies relative to their market economy peers – this was true right across the GDP per capita distribution. However, these networks were geared to the transportation of freight between enterprises according to the plan. The supply-chains linked by the rail network often collapsed when planning and the trading arrangements in the CMEA were abandoned and the value of the remaining rail network to firms in the market economy is almost certainly not well-measured by the kilometres of track per capita (e.g. EBRD, 1996).

The second problem is that even if we can reliably distinguish the quality of such institutions as the rule of law in one country from that in another, this does not say anything about whether problems with the rule of law are more or less of a constraint on private sector growth than are problems with, say, electricity. Since the distortions under planning were potentially positive for future growth prospects in relation to infrastructure and education and negative in relation to market institutions, we need a methodology that enables us to make comparisons across types of public input in the economies that were exposed to planning and in those that were not.

The standard approach to this problem is to use aggregate cross-country or panel data to estimate a production function augmented by proxies for the public input(s) of interest. The impact on growth of the element of infrastructure or type of institution is inferred from the estimated coefficient. However, the production function approach implicitly relies on measures of the flow of services from the public inputs, which are not observable. Moreover even if the flow of services from public inputs could be measured accurately and if satisfactory instrumental variables existed to deal with reverse causality, the production

function approach runs into problems of the curse of dimensionality. Public inputs vary only at the country level (or regional level in large countries) and there are too many such inputs, and too many other determinants of output and growth, to be able to estimate precisely the different impacts (Durlauf et al., 2005). This makes it very difficult to test for the *relative* importance of a wide range of public inputs, as is required to explore the questions about the legacy of planning that we set out at the beginning.

An alternative strategy is to incorporate in a conventional production function approach measures of infrastructure and institutions derived from firm-level data. The attraction of firm level data is that they appear to greatly increase the sample size and therefore to make it possible to identify separately the effect of different elements of infrastructure and institutions on growth using a firm-level econometric model. Commander and Svejnar (2011) and Commander and Nikolaski (2011) analyze transition economies and are the most relevant studies of this kind.[5] The data they use are scores given by managers of the severity of the obstacles they face in operating and expanding their firm from a wide range of elements of their external environment – from electricity to corruption. Their tests of the relative importance of a variety of public inputs did not produce clear results. The methodological problems are twofold. First, in effect, the sample size is actually small: because all the firms in a country face the same set of institutions, it is the number of countries rather than the number of firms that drives the effective sample size. Second, as we shall argue below, the survey scores are themselves measures of impact and should not be used as proxies for the flow of services. The empirical challenges of this approach are therefore effectively the same as those facing studies using aggregate data: there are too few different country experiences, and too many imperfectly measured and correlated indicators, to be able to precisely identify the causal impacts of different public inputs on output and growth.

To understand whether planning left countries with different constraints on growth from their non-planning peers, we need a different methodology. In this section we show how a large microeconomic database of firm-level survey responses (including the data used in the studies referred to above) can be deployed to address the shortcomings of the production function approach and provide insight on the value of the legacies of planning. The data come from the large number of surveys of firms conducted by the EBRD and World Bank between 2002 and 2010. A standard question was asked in which managers were required to evaluate the importance for the operation and growth of their business of a broad range of public inputs. In the context of the transition economies, these data are attractive because they come from the mainly new population of small and medium-sized firms, providing a window into the value to them of the inherited infrastructure (such as the railway tracks), and of the emerging market institutions.

The enterprise surveys collect a range of "Subjective Severity" indicators from firms. These are responses to questions about a feature of the business environment faced by the firm, where the question takes the form, "How much of an obstacle is X to the operation and

[5] Among other studies using an augmented production function approach with the various subsets of the business environment survey data are Beck et al. (2005), Hallward-Driemeier, et al. (2006), Dollar et al. 2005 and Hallward-Driemeier and Aterido, 2009.

growth of your business?", and the respondent rates the severity on a 5-point scale of 0 ("no obstacle") to 4 ("very severe obstacle"). The dimensions of the external environment asked about include the following: telecoms, electricity, transport, skills availability, macroeconomic/political/policy stability, tax administration, customs administration, labour regulation, the legal system, corruption and crime.[6] A simple and intuitive interpretation of the responses to these questions is that these are the firm's assessments of the costs it incurs because of operating in an environment with poor-quality public inputs.

In contrast to their use on the right hand side of a production function as proxies for the flows of services from various public inputs, this interpretation (following Carlin et al. 2006, 2010) sees them as shadow prices. The shadow price interpretation rests on the assumption that firms have a notion of the flows of services from the different elements of their business environment, and that their answer puts a value on them in terms of their impact on profitability. If a firm reported, say, the legal system as an important obstacle, this can be interpreted as a high shadow price: a relaxation of this constraint via an improved legal system would therefore be expected to reduce the shadow price and lead to higher profits and increased output. If most firms in a country report that the legal system is an important obstacle, then the high average shadow price allows us to infer that this particular public input is underprovided.[7]

By using a framework in which we observe firm valuations of public inputs directly, we circumvent the problems that arise in a standard production function approach where values of different public inputs are inferred from the estimated impacts on output. These valuations can be readily aggregated and compared across countries and across inputs. The result is a set of equations which we take to the data to answer the questions about legacy effects by comparing transition and non-transition countries.

*Model*

We follow Carlin et al. (2006, 2010) and interpret the answers to the subjective severity questions as reflecting the shadow price of public inputs. We use a simple single-period firm production function with two inputs, *L* and *B*, which are combined to produce output *Y*. *L* is employment; it is a variable input with no adjustment costs. *B* is the flow of services from a public input. We normalize the price of output *Y* to 1. Firms differ in productivity, captured by a multiplicative productivity parameter *A*. We index countries by *j* and firms by *i*. We assume the public input is supplied on identical terms to all firms in a country, so we write it as $\overline{B}_j$. Although the aggregate measures reported in Section 2 may capture some aspects of $\overline{B}_j$, the flow of public inputs to the firm is not observable. $\overline{B}_j$ captures the notion of a shared "business environment". The production function is:

$$Y_{ij} = A_{ij} F(L_{ij}, \overline{B}_j). \qquad (3)$$

[6] Although questions are asked in the survey about tax rates and access to finance, we exclude them from the analysis because they do not have the character of public inputs (Carlin et al. 2010). We also exclude the question about competition since the wording changed substantially over time and surveys.

[7] An important implication of the shadow price interpretation for firm-level studies is that it is inappropriate to include the scores as indicators of the flow of services on the right hand side of a production function. See Carlin et al. (2006, 2010) for further discussion.

Firms choose $L$ to maximize profits $\pi$ for given technology $A$, public input $B$, and relative price of $L$, $w_j$. Denoting a maximum-value function by a superscript *: we have:

$$L_{ij}^{*} = L^{*}(A_{ij}, \overline{B}_j, w_j) \tag{4}$$

$$\pi_{ij}^{*} = \pi^{*}(A_{ij}, \overline{B}_j, w_j) = A_{ij}F(L_{ij}^{*}, \overline{B}_j) - w_j L_{ij}^{*}. \tag{5}$$

Our aim is to compare the impact of a public input on firm performance in different countries or types of countries without the need to measure $\overline{B}_j$. We refer to the firms' responses to the business environment questions (the ranking from "no obstacle" to "very severe obstacle") as the firm's "reported cost" $R_{ij}$ of a public input. We interpret it as the gap between the firm's profit in the hypothetical situation where the public input provided is of sufficient quality that it poses a negligible obstacle to the firm's operations and growth, and the firm's profit in reality, given the actual quality of public input provided.

If we denote the level of public input provided in an ideal, high-quality business environment as $\overline{\overline{B}}_j$, we have

$$R_{ij} = \pi^{*}(A_{ij}, \overline{\overline{B}}_j, w_j) - \pi^{*}(A_{ij}, \overline{B}_j, w_j). \tag{6}$$

The marginal analogue of the reported cost $R_{ij}$ for small changes in the public input is therefore simply the derivative of the profit function:

$$R_{ij} \approx \frac{\partial \pi_{ij}^{*}}{\partial \overline{B}_j} \equiv \lambda_{ij}. \tag{7}$$

By the envelope theorem for constrained maximization, the derivative of the profit function $\pi_{ij}^{*}$ with respect to a constrained or fixed input is simply the shadow price of the input $\lambda_{ij}$. For this reason, Carlin et al. (2006) suggest we can interpret the responses to "Subjective Severity" questions as the shadow prices of shortcomings in the public input $\overline{B}_j$. Two straightforward results are that the shadow price of $\overline{B}_j$ is decreasing in $\overline{B}_j$:

$$\frac{\partial \lambda_{ij}}{\partial \overline{B}_j} \equiv \frac{\partial^2 \pi_{ij}^{*}}{\partial \overline{B}_j^2} < 0 \tag{8}$$

and is increasing in the productivity of the firm:

$$\frac{\partial \lambda_{ij}}{\partial A_{ij}} \equiv \frac{\partial^2 \pi_{ij}^{*}}{\partial \overline{B}_j \partial A_{ij}} > 0 \tag{9}$$

i.e., a higher productivity firm will report higher costs of a poor public input than a lower productivity firm – even though they share the same business environment.

The first step in taking the model to the data is simply to linearize and add an error term $\eta_{ij}$:

$$R_{ij} = \alpha_0 + \alpha_1 A_{ij} + \alpha_2 \overline{B}_j + \eta_{ij}, \tag{10}$$

where we expect that $\alpha_1 > 0$ and $\alpha_2 < 0$. Since our focus in this paper is variation across countries rather than across firms within countries,[8] we say that firm productivity is randomly distributed around a country-specific mean:

$$A_{ij} = \bar{A}_j + e_{ij}. \tag{11}$$

Mean productivity $\bar{A}_j$ is also a proxy for a country's level of development or income per capita, and we expect provision of public inputs to vary systematically with income as we saw using aggregate proxy indicators for public inputs presented in Figures 2 and 3. We use a simple linear formulation for the country provision of public input $\bar{B}_j$:

$$\bar{B}_j = \beta_0 + \beta_1 \bar{A}_j + u_j, \tag{12}$$

where $u_j$ is a country-level error term.

Substituting equations (11) and (12) into (10), the equation for reported cost $R_{ij}$, we obtain

$$R_{ij} = \delta_0 + \delta_1 \bar{A}_j + \upsilon_{ij} \tag{13}$$

where

$$\delta_0 \equiv \alpha_0 + \alpha_2 \beta_0 \tag{14}$$

$$\delta_1 \equiv \alpha_1 + \alpha_2 \beta_1 \tag{15}$$

and $\upsilon_{ij}$ is a composite error term:

$$\upsilon_{ij} \equiv \eta_{ij} + \alpha_1 e_{ij} + \alpha_2 u_j. \tag{16}$$

The slope of the relationship in (13) will be positive or negative depending on the values of the parameters $\alpha_1$, $\alpha_2$ and $\beta_1$. For example, if public input provision increases quickly enough with income (large $\beta_1$) and/or the shadow price of the input falls quickly as provision improves (large $\alpha_2$), both relative to how quickly the shadow price of the input increases with firm productivity ($\alpha_1$), the income-reported cost relationship will be downward sloping. Equation (13) can be implemented empirically by using GDP per capita for $\bar{A}_j$. The dependent variable is the $R_{ij}$ for a particular public input reported by firm *i* in country *j*. The resulting parameter estimates can be used together with a chosen reference level of income for $\bar{A}_{ref}$ to obtain a predicted value $\hat{R}_{ref}$. The interpretation of $\hat{R}_{ref}$ is that it is the reported cost or shadow price we would predict for a typical firm in a country with income $\bar{A}_{ref}$. This predicted value is a statistic, and hence we can use it in hypothesis testing or to construct confidence intervals.

This approach allows us to compare the impact of a public input on firm performance in different countries or types of countries without the need to measure $\bar{B}_j$. We augment the public input provision equation (12) with TE slope and intercept dummies, estimating separately for each public input *p*:

$$\bar{B}_j = \beta_{0p} + \beta_{1p} \bar{A}_j + \beta_{2p} TE_j + \beta_{3p} (TE_j * \bar{A}_j) + u_{jp} \tag{17}$$

[8] See Carlin et al. (2006, 2010) for applications of this framework that explore the relationship between $R_{ij}$ and firm productivity.

and then to obtain a feasible estimating equation in observables, we substitute (11) and (17) into (10) and get our basic reported cost estimating equation:

$$R_{ijp} = \delta_{0p} + \delta_{1p}\overline{A}_j + \delta_{2p}TE_j + \delta_{3p}(TE_j * \overline{A}_j) + \upsilon_{ijp} \tag{18}$$

where $\delta_{0p}$, $\delta_{1p}$ and $\upsilon_{ijp}$ are defined as earlier, and

$$\delta_{2p} \equiv \alpha_{2p}\beta_{2p} \tag{19}$$

$$\delta_{3p} \equiv \alpha_{2p}\beta_{3p}. \tag{20}$$

It is important to note that the parameters $\beta_0$ and $\beta_1$ relating country income to public infrastructure provision in equations (12) and (17) need not have a structural interpretation.[9] Rather, country income is being used here as a control, and the predicted reported costs $\hat{R}$ obtained from the estimation of equation (18) should be interpreted simply as estimates conditional on country income. Instead of working with parameters $\beta_{2p}$ and $\beta_{3p}$, we work with the parameters scaled by $\alpha_{2p}$. The rescaled parameters $\delta_{2p}$ and $\delta_{3p}$ in effect allow us to answer the question whether there are differences in firm *valuations* of public input *p* between transition and market economies at comparable incomes. Since we allow both position and the slope of the income-public input relationship to differ between transition and non-transition economies, the answer to this question depends on the level of income where we are making the comparison. We choose the same two reference incomes as Section 2 for our comparison, $\overline{A}_{poor}$ =log($3,500) and $\overline{A}_{rich}$ =log($16,500).

The parameter values obtained by estimating (18) combined with these reference income levels generate the following predicted values for poor (P) and rich (R) TEs and NTEs:

$$\hat{R}_{PNTE,p} = \hat{\delta}_{0p} + \hat{\delta}_{1p}\overline{A}_{poor}, \tag{21}$$

$$\hat{R}_{RNTE,p} = \hat{\delta}_{0p} + \hat{\delta}_{1p}\overline{A}_{rich}, \tag{22}$$

$$\hat{R}_{PTE,p} = (\hat{\delta}_{0p} + \hat{\delta}_{2p}) + (\hat{\delta}_{1p} + \hat{\delta}_{3p})\overline{A}_{poor}, \tag{23}$$

$$\hat{R}_{RTE,p} = (\hat{\delta}_{0p} + \hat{\delta}_{2p}) + (\hat{\delta}_{1p} + \hat{\delta}_{3p})\overline{A}_{rich}. \tag{24}$$

These four predicted values are statistics, and can be readily compared using standard least squares regression and hypothesis tests. We are interested in particular in the following comparisons, illustrated in the left hand panel of Fig. 4, which capture how the impacts on firms of provision of public input *p* differ between TEs and NTEs at similar income levels, ($DLINC_p$ and $DHINC_p$)

$$DLINC_p \equiv \hat{R}_{PTE,p} - \hat{R}_{PNTE,p} = (\hat{\delta}_{2p} + \hat{\delta}_{3p}\overline{A}_{poor}) = \hat{\alpha}_{2p}(\hat{\beta}_{2p} + \hat{\beta}_{3p}\overline{A}_{poor}),$$

$$DHINC_p \equiv \hat{R}_{RTE,p} - \hat{R}_{RNTE,p} = (\hat{\delta}_{2p} + \hat{\delta}_{3p}\overline{A}_{rich}) = \hat{\alpha}_{2p}(\hat{\beta}_{2p} + \hat{\beta}_{3p}\overline{A}_{rich}).$$

Finally, we can use the fitted values to test the differences in the *rankings* of the reported costs of different public inputs. How do the shadow prices of different public inputs compare in poor transition and non-transition countries and how do these rankings change with income? We construct four sets of rankings of public inputs from the four sets of fitted

[9] For example, we expect income to affect infrastructure provision – richer countries can afford more – but we also expect infrastructure provision to affect income – more infrastructure raises country income.

values $\hat{R}_{PTE,p}$, $\hat{R}_{RTE,p}$, $\hat{R}_{PNTE,p}$ and $\hat{R}_{RNTE,p}$. The statistical tests of the rankings are simple Wald tests of the differences between these fitted values. For example, if public input *p* is ranked above public input *q* for poor TEs, we report whether the difference $(\hat{R}_{PTE,p} - \hat{R}_{PTE,q})$ is significantly different from zero, and similarly for the other three categories of countries. The vertical distances shown in Fig. 4(b) illustrate the tests that can be carried out.

*Data*

The surveys used here were conducted over a period of 9 years, from 2002 to 2010, and covered around 62,000 manufacturing firms in 202 separate surveys in 111 countries (see Appendix Table A2). Basic statistics on the surveys are presented in Table 4. Most of the surveyed firms are small or medium-sized enterprises (SMEs); mean log employment is about 35 persons. Most of the data on firms in transition countries, and a small number of surveys of firms in market economies, were collected in the Business Environment and Enterprise Performance Surveys (BEEPS) conducted by EBRD; data on firms from the rest of the world, and a handful of additional surveys for transition countries, come from the World Bank's Enterprise Surveys (ES) programme. The original surveys collect data from both manufacturing and services firms. We limit our analysis to privately-owned manufacturing firms to reduce the heterogeneity in the sample; the results of the analysis are in any case very similar when extended to include firms in services. Roughly 17% of the sample, or about 10,000 firms, were drawn from transition countries. Slightly more than half of TE firms in the sample were surveyed between 2002 and 2005 (BEEPS II and III, plus a handful of non-BEEPS surveys). Another survey of firms in transition countries (BEEPS IV) was conducted in 2008-09. We present below two separate analyses. First, we analyse the findings from the BEEPS II-III surveys, which took place relatively early in the period of economic recovery. We then look at the results from the BEEPS IV surveys that took place at the end of the recovery period and just prior to the global economic crisis.

*Empirical strategy*

In the estimation of equation (18) we want to control for firm characteristics such as size and international engagement, i.e., we want to estimate

$$R_{ijp} = \delta_{0p} + \delta_{1p}\bar{A}_j + \delta_{2p}TE_j + \delta_{3p}(TE_j * \bar{A}_j) + X_{ij}\Gamma_p + \upsilon_{ijp} \qquad (25)$$

where $X_{ij}$ is a vector of firm characteristics and a corresponding parameter vector $\Gamma_p$. The primary motivation for controlling for firm characteristics is that we do not want our comparisons across countries to be affected by differing sample compositions in the surveys used or by the compositions of the populations of firms. The characteristics $X_{ij}$ are defined so that $X_{ij} = 0$ defines a "benchmark firm"; for example, our benchmark firm is domestically-owned, and hence $X_{ij}$ includes a dummy variable $FO_{ij}$ which equals 1 when the firm is foreign-owned and equals 0 when it is domestically-owned. Because the benchmark firm is defined at $X_{ij} = 0$, the predicted reported costs $\hat{R}$ in equations (21) through (24) are unchanged. The effect is to define conditional means that can be interpreted

as the country means for a benchmark firm with a defined set of characteristics that is the same for every country. These conditional means are the focus of our tests of legacy effects.

We use the following two-step estimation procedure. In the first step, we obtain estimates of the parameter vector $\Gamma_p$ from an estimation with survey fixed effects. We estimate separately for TEs and NTEs so that the parameter vector $\Gamma_p$ can vary for the two groups of countries. The residuals and fixed effects are then used to construct estimates of the reported costs $\tilde{R}_{ijp}$ with the firm characteristics $X_{ij}$ partialled out. In the second step, estimates of $\hat{R}_{PTE,p}$, $\hat{R}_{RTE,p}$, $\hat{R}_{PNTE,p}$ and $\hat{R}_{RNTE,p}$ are obtained for each public input *p* by regressing the partialled-out reported costs $\tilde{R}_{ijp}$ on log GDP per capita interacted with the TE dummy as regressors and then calculating the desired fitted values.[10]

The benchmark firm is privately owned and in manufacturing, by virtue of the construction of the datasets used. It has 30 employees, less than 10% foreign ownership, is exporting less than 10% of its sales, and is not a direct importer of inputs. The first step thus estimates the following fixed-effects regression separately for TEs and NTEs:

$$R_{ijp} = \gamma_{1p} L30_{ij} + \gamma_{2p} FO_{ij} + \gamma_{3p} EX_{ij} + \gamma_{4p} IM_{ij} + f_{jp} + \varepsilon_{ijp}, \qquad (26)$$

where the variable L30 is log(L/30),[11] $f_{jp}$ is the survey-specific fixed effect and the remaining variables are dummies corresponding to the characteristics listed above. The benchmark reported cost of input *p* for firm *i* in country survey *j* from this first-step estimation is simply:

$$\tilde{R}_{ijp} = \hat{f}_{jp} + \hat{\varepsilon}_{ijp}.$$

$\tilde{R}_{ijp}$ is then used as the dependent variable in estimation by OLS of

$$\tilde{R}_{ijp} = \delta_{0p} + \delta_{1p}\bar{A}_j + \delta_{2p} TE_j + \delta_{3p}(TE_j * \bar{A}_j) + \zeta_{ijp}. \qquad (27)$$

The estimated parameters from (27) and the reference income levels and country group definitions give us our estimates of $\hat{R}_{PTE,p}$, $\hat{R}_{RTE,p}$, $\hat{R}_{PNTE,p}$ and $\hat{R}_{RNTE,p}$, and of $DLINC_p$, and $DHINC_p$ (see Fig. 4a).

The statistical tests of how the reported costs for a single public input *p* differ across reference income levels and country groups are conducted using Wald tests and the estimated parameters of equation (27); the covariance estimator used is robust to heteroskedasticity. To test for whether, for a given country group and income level, the reported costs $\hat{R}$ of two constraints *p* and *q* differ, we use the corresponding two estimations of (27) and perform a Wald test with a cluster- and heteroskedasticity-robust covariance estimator that accounts for the possible within-firm correlation of the two error terms $\zeta_{ijp}$ and $\zeta_{ijq}$.[12]

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[10] The advantage of this two-step procedure, besides computational simplicity, is robustness. Direct estimation of equation (25) would require the assumption that the firm characteristics $X_{ij}$ are orthogonal to the full composite error term $v_{ijp}$, including the country-specific error $u_j$. The fixed-effects first step in the procedure we actually use assumes only that the firm characteristics are orthogonal to the idiosyncratic error $\varepsilon_{ijp}$ (see Appendix Table A3).

[11] Log(L/30) = log(L)-log(30), i.e., our size measure is constructed so that it takes the value zero for a firm with 30 employees.

[12] The Stata command used to pool the estimates of equation (27) for each input *p* is *suest* with clustering by firm. The results are equivalent to stacking the dataset by public input, interacting the regressors in equation

## 5. How salient were the legacies of communism for growth in the market economy?

*After a decade of transition*

We address this question by using the data on reported costs of public input constraints. The aim is to test the hypothesis that differences in the burdens imposed on the growth of firms by unreliable public inputs can be linked to the legacies of planning. The firm-level data allow us to look separately at three elements of physical infrastructure (electricity, transport and telecommunications), access to skilled labour, and a number of institutional inputs. This means we can see whether there is evidence in 2002-05 of the impact on firms of the greater endowments of physical infrastructure and education with which countries ended planning (relative to their GDP per capita comparators) and the gaps in market institutions with which they entered transition.

Table 5 summarizes how the different elements of the external environment are rated at two different levels of GDP per capita (poor = $3,500 and rich = $16,500) in transition and non-transition countries. Cells coloured gold (bold italics) signify a rating above the full sample mean of 1.1, while blue signifies those below.[13]

When we compare poor transition and non-transition countries, legacy effects of planning are clear (column headed DLINC): in terms of their external environment, firms in poor TEs were poor in different ways from firms in NTEs. Firms in poor transition countries benefited from more satisfactory provision of physical infrastructure, access to skilled labour, access to land, were less burdened by labour regulation and reported lower costs from crime and theft than did firms in poor countries outside transition. They reported more serious problems than poor countries outside transition in relation to policy uncertainty and a number of aspects of the institutional environment: tax administration, customs, business licensing and courts.

When comparing richer countries inside and outside transition (DHINC), the differences were fewer (Fig. 3, column headed DHINC). This is consistent with the hypothesis that countries that had undergone industrialization as market economies had institutional legacies stretching back beyond the planning era. The institution that stands out in this regard is labour regulation. Firms in richer transition economies rated problems with labour regulation in a similar way to firms in richer market economies, i.e. as more serious than the average. This marks out rich transition and non-transition countries from both sets of poor countries.

Drawing the results together, the picture that emerges is that the legacy effects of investment in physical infrastructure and education under planning were still apparent in poor transition economies in the survey data of 2002-2005. In rich ones, electricity continued to pose fewer problems than was the case for firms outside transition but there was no difference with their non-transition comparators in relation to educated labour and the other

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(27) with dummies for each input, estimating by OLS (so that the estimated coefficients are identical to those obtained when estimating equation-by-equation) and using the cluster-robust covariance estimator for testing.

[13] In Tables 3 and 5, we use a fairly high threshold for "significance", i.e., we require the absolute value to be different from 0.1. This is a way of capturing both "statistical significance" and "economic significance". In Appendix Table A4, where the second stage results are reported, standard errors are shown in the usual way with bold italics used to indicate the coefficients that are significantly different from zero.

aspects of physical infrastructure. On the institutional side, it is clear that for both poor and richer transition economies, firms in transition countries were more troubled by burdens imposed by courts, tax administration, customs, and policy uncertainty than was the case outside transition. These results underline the initial hypothesis that the two groups of transition economies are different. Planning accelerated the industrialization of poor countries, leaving them with features quite distinct from their market economy peers.[14]

We turn now to the within-group ordering of the importance of constraints. Table 6 presents the analysis of the ranking of constraints for each country group based on the tests of the differences between the reported costs of constraints. The diagonals show the estimated $\hat{\delta}_{3p}$ in equation (27) for obstacle *p* in a particular country group. The row/column off-diagonals report the results of testing whether, for a given country group, the estimated $\hat{\delta}_{3p}$ for the row obstacle *p* is significantly different from the $\hat{\delta}_{3q}$ estimated for the column obstacle *q*. To facilitate comparison of ranks across the country groups, we have coloured the physical infrastructure elements in blue, access to skilled labour is yellow, macroeconomic constraints are pink and institutions are white (with courts in grey). Based on the tests of differences, the constraints can be grouped into 5-7 sets according to their reported severity. The sets are shown by the bold boxes in Table 6.

It is immediately clear from Table 6 that there are some common patterns in how constraints are ranked across country groups. In the light of the debate about the Washington and post-Washington consensus, it is striking that macroeconomic stability and government policy uncertainty show up as the elements of the external environment of most concern to firms in all country groups. Telecoms is bottom-ranked in each country group, which may be a reflection of the extent to which telephony is now considered by firms to be a private rather than a public good.

Looking first at the two groups of transition countries, we see that all three elements of physical infrastructure are at the bottom of the rankings. As might be expected in the light of the emphasis on education under planning, for the poor transition economies, access to skilled labour is also low-ranked and not viewed as a major obstacle to growth. For both groups, the courts are ranked high among institutional constraints.

When comparing how constraints are ranked in the relevant peer market economy group, we see confirmation of the result we have seen through different lenses before: it is across the two groups of poor countries where stark differences appear (the top two panels of Table 6). Electricity is a serious problem for firms outside transition; the courts are not. The reverse is the case for poor transition countries. Firms in richer transition economies ranked constraints in a more similar way to their comparators outside transition than was the case for poor TEs (the bottom two panels in Table 6). Between the two groups of richer countries, the main differences were that the courts were ranked toward the top and access to skilled labour well down the list in transition whereas the reverse was the case outside transition. The

[14] Appendix Table A4 confirms the difference between the two groups of transition economies and their market economy peers highlighted in the DLINC and DHINC columns of Table 3. If differences between TEs and NTEs were shared equally across the income distribution, the slopes of the TE and NTE lines would be equal and the slope dummy would be insignificant. As Table A4 shows ( $\delta_3$ column), it is almost always significant.

difficulties reported in relation to the courts in the richer transition economies suggest that although some institutions could be re-established relatively quickly, problems with the judicial system persisted. Overall, this suggests a conclusion reminiscent of Tolstoy: rich countries resemble one another whether they underwent planning and transition or not; poor countries are unhappy in their own different ways.

*Legacy effects in 2007-09 following rapid growth*

Another round of surveys was conducted in 2007-09 on the eve of the global financial crisis.[15] This offers us the opportunity to observe whether the legacy effects of planning persisted through the period of strong growth.

Tables 7 and 8 present the results. The results for the non-transition groups are from surveys pooled over all available years and therefore differ from those in Tables 5 and 6 only because of the changes in the set of constraints included. Small changes in the survey design affect the comparison of results from the baseline period.[16] For the transition countries, the results for 2007-09 suggest that the pressure of rapid growth was reflected in the evaluation of the external constraints firms faced. As compared with the non-transition economy sample (which pools all of the surveys administered between 2002 and 2010) firms in transition economies in 2007-09 reported higher costs of constraints virtually across the board (see DLINC and DHINC columns of Table 7). In both groups, the extent to which electricity was viewed as a problem increased markedly in the 2007-09 survey.[17] Priorities for firms (reflected in the ranking of external constraints in Table 8) had changed a great deal and the value of inherited legacies appears to have eroded by 2007-09. In both poor and rich transition economies, electricity moved from close to the bottom to the top-ranked set of constraints. Problems with availability of skilled labour also emerged as serious in both groups of countries, where it moved from well down the ranking to the top-ranked set in the rich transition economies and the second-ranked set in the poor ones.

Plausible reasons for the emergence of electricity and skills as serious obstacles for firms in transition are on the one hand the depreciation of the initial high endowments and

[15] We use other questions in the survey to check whether the results of the 2007-09 round were contaminated by the early effects of the financial crisis. Although in our analysis in this paper we do not use the questions on access to or cost of finance, we can use the answers to those questions to check for evidence of the credit crunch. While the average complaint level across all dimensions of the business environment rises in 2007-09 compared to 2005, the 2007-09 complaint level for problems related to finance remains similar to 2002 and 2005. This evidence from the finance question suggests that the responses from BEEPS IV should be interpreted as "the eve of the financial crisis" rather than "early in the financial crisis".

[16] The main change was that the questions on government policy uncertainty and macroeconomic stability were dropped. A related question was asked instead on political instability. The question about telecoms was also dropped for manufacturing firms. In short, the top- and bottom-ranked constraints were dropped.

[17] Although there may be concern that the higher reported constraints in relation to electricity reflect the oil price spike in 2007 rather than the reliability of the infrastructure, other evidence does not support this. For example, the correlation between power outages and electricity as a constraint is stronger in 2008 than in previous years in the transition economies. Moreover, unlike the transition economies, there is no increase in electricity complaints in 2008 in Turkey, which was also surveyed in that year as part of BEEPS IV, supporting the conclusion that this is a transition-specific phenomenon and not a reflection of changes in world energy prices. Additional support for the hypothesis that capacity and or access constraints rather than price effects dominate comes from the fact that it is firms that expanded employment by more than 10% over the previous three years that complain more about electricity.

inadequate investment during transition, and on the other, a greater mismatch between endowments and the needs of firms in the market economy in a phase of rapid growth. Our data do not allow us to distinguish cleanly between the contributions of each of these. Since the transition economies retained their advantage over comparable non-transition economies in the aggregate indicators of physical infrastructure capacity and education between the beginning of transition and 2008 (Table 3), our results suggest that although the communist legacy brought with it comparatively high quantities of these public inputs (measured at national level), qualitative aspects such as geographical distribution and orientation toward the needs of highly vertically integrated production and distribution systems were increasingly revealed as ill-suited to the market economy environment. An example that reflects the rigidity of the planning system was the orientation of the railway network to service the needs of heavy industrial users and the haulage of raw materials. More generally, higher reported costs are likely to relate to issues such as the flexibility of access to the grid; tariff structures; balance of transport modes and tariffs; and the value of the existing mix of qualifications and skills. There are numerous descriptions in the literature of the mismatch between inherited infrastructure and best practice arrangements in a market economy (e.g., EBRD, 1996, Carbajo and Fries, 1997, Aghion and Schankerman, 1999, von Hirschhausen, 2002, Feinberg and Meurs, 2008). The firm-level data suggest that the predicted mismatches did not emerge as constraints on firms until the end of the second decade of transition.

## 6. Conclusion

We suggested at the outset that an evaluation of the legacy of central planning was likely to involve a trade-off between the adverse effects of static allocative inefficiency and poor incentives for innovation, and the beneficial effects of provision of greater quantities of physical infrastructure and human capital than was typical of non-transition countries. We have shown that the overall terms of this trade-off depended to a striking extent on countries' initial levels of development. Planning appears not to have hampered the development of initially poor countries. Indeed, there is evidence that for initially poor countries, the long-run benefits of physical infrastructure and human capital substantially outweighed the long-run economic costs of static inefficiencies and weak innovation incentives. Furthermore, countries that were still poor at the end of the central planning era were quite different from other poor countries, and appeared to benefit in the market economy from the legacy effects of their infrastructure and human capital endowments. However, their ability to take advantage of the opportunities of the market economy was limited by obstacles such as poor courts and tax administration, which had not been a handicap under central planning but were so to a high degree afterwards.

The late adopters of planning among the initially more prosperous countries ended up no better off, and the early adopters ended up substantially worse off than their pre-planning peers. Countries that were already comparatively prosperous before the imposition of central planning appear to have benefited less from the infrastructure and human capital advantages of planning, and suffered more from the costs of losing market incentives.

To uncover evidence on the hypothesized channels from the initial level of development to how countries fared under planning, we turned to the transition years and legacy effects. We analyzed firm-level data reporting how various aspects of their business

environment affected opportunity for firms to grow. In 2002-2005 after more than a decade of transition, firms in rich TEs were found to benefit less from infrastructure and education advantages over their NTE peers than do those in poor TEs, and are hampered by weaknesses in market institutions different from those that are most problematic in NTEs. Overall, though, rich transition countries differ less from their non-transition counterparts than do poor transition countries, which continue to have strengths and to face handicaps that are quite unlike those of poor countries that never went through the central planning process.

Finally, we tested whether the legacy effects of Soviet planning, which persist in the aggregate data on infrastructure and education in 2008, continue to reflect the evaluation by firms of their external environment in the years of strong growth running up to the global financial crisis. We found that they do not. In the 2007-09 survey, firms in transition economies report higher costs of their external business environment than do NTE firms. Most striking is the disappearance of the advantage of poor transition economies in electricity and education. In poor and rich TEs, electricity and education are rated as more costly to the firm than is the case outside transition and both are highly ranked as compared with other aspects of the external environment. Taken together with the results of the 2002-2005 surveys, this suggests that the initial advantages of transition economies in terms of the quantity of prior investments in infrastructure and human capital masked quality handicaps which caught up with these countries as growth went ahead. A year of education and a kilometer of railway track in a TE were simply less productive than a year of university and a kilometer of track in a non-TE, and the fact that formerly planned economies began transition with higher quantities of both was not enough to protect them from the consequences of these quality handicaps.

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## Table 1a: GDP per capita in Central Planning: Early Adopters and Comparators

| Country | Code | 1913 | 1988 | 2008 |
|---|---|---|---|---|
| **Early adopters** | | | | |
| Armenia | ARM | 1,669 | 3,154 | 5,615 |
| Azerbaijan | AZE | 1,669 | 6,075 | 8,024 |
| Belarus | BLR | 2,135 | 6,669 | 11,747 |
| Georgia | GEO | 1,669 | 7,780 | 4,516 |
| Kazakhstan | KAZ | 925 | 7,219 | 10,469 |
| Kyrgyz Republic | KGZ | 925 | 2,395 | 2,043 |
| Russian Federation | RUS | 2,135 | 13,066 | 14,767 |
| Tajikistan | TJK | 925 | 3,363 | 1,781 |
| Turkmenistan | TKM | 925 | 4,098 | 6,326 |
| Ukraine | UKR | 2,135 | 8,348 | 6,721 |
| Uzbekistan | UZB | 1,376 | 2,004 | 2,455 |
| **Comparators, Europe & West/Central/South Asia** | | | | |
| Bangladesh | BGD | 925 | 723 | 1,356 |
| Greece | GRC | 2,190 | 17,045 | 26,900 |
| India | IND | 925 | 1,159 | 2,781 |
| Iran, Islamic Rep. | IRN | 1,376 | 5,440 | 10,398 |
| Iraq | IRQ | 1,376 | 6,478 | 3,560 |
| Jordan | JOR | 1,376 | 4,051 | 5,108 |
| Lebanon | LBN | 1,857 | 8,044 | 11,017 |
| Nepal | NPL | 742 | 682 | 1,021 |
| Pakistan | PAK | 925 | 1,569 | 2,317 |
| Portugal | PRT | 1,721 | 14,625 | 21,962 |
| Sri Lanka | LKA | 1,698 | 1,877 | 4,150 |
| Syrian Arab Republic | SYR | 1,858 | 3,263 | 4,512 |
| Turkey | TUR | 1,669 | 7,642 | 12,406 |
| **Comparators, Other** | | | | |
| Algeria | DZA | 1,601 | 6,213 | 7,367 |
| Brazil | BRA | 1,116 | 7,519 | 9,583 |
| Colombia | COL | 1,701 | 5,784 | 8,250 |
| Egypt, Arab Rep. | EGY | 1,241 | 3,047 | 5,216 |
| Ghana | GHA | 1,074 | 882 | 1,380 |
| Hong Kong SAR, China | HKG | 1,760 | 22,617 | 40,579 |
| Indonesia | IDN | 1,203 | 1,749 | 3,570 |
| Jamaica | JAM | 837 | 5,388 | 7,344 |
| Japan | JPN | 1,908 | 23,665 | 31,307 |
| Korea, Rep. | KOR | 1,196 | 9,977 | 25,517 |
| Malaysia | MYS | 1,239 | 5,884 | 12,930 |
| Mexico | MEX | 2,383 | 9,497 | 12,932 |
| Morocco | MAR | 977 | 2,625 | 3,973 |
| Myanmar | MMR | 943 | 1,042 | 4,275 |
| Peru | PER | 1,421 | 5,573 | 7,967 |
| Philippines | PHL | 1,360 | 2,453 | 3,382 |
| Singapore | SGP | 1,760 | 22,187 | 47,995 |
| South Africa | ZAF | 2,204 | 8,154 | 9,602 |
| Taiwan | TWN | 1,007 | 12,544 | 30,476 |
| Thailand | THA | 1,157 | 3,251 | 7,378 |
| Tunisia | TUN | 1,215 | 3,797 | 7,357 |
| Venezuela, RB | VEN | 1,519 | 10,311 | 11,756 |

## Table 1b: GDP per capita in Central Planning: Late Adopters and Comparators

| Country | Code | 1937 | 1988 | 2008 |
|---|---|---|---|---|
| **Late adopters** | | | | |
| Albania | ALB | 1,578 | 4,058 | 7,223 |
| Bosnia and Herzegovina | BIH | 1,391 | 2,797 | 5,382 |
| Bulgaria | BGR | 2,156 | 8,323 | 12,005 |
| Croatia | HRV | 1,947 | 14,446 | 17,317 |
| Czech Republic | CZE | 4,622 | 16,510 | 23,223 |
| Estonia | EST | 4,735 | 10,641 | 18,646 |
| Hungary | HUN | 3,499 | 12,551 | 17,442 |
| Latvia | LVA | 4,735 | 10,381 | 15,662 |
| Lithuania | LTU | 2,636 | 12,986 | 17,616 |
| Macedonia, FYR | MKD | 1,202 | 9,290 | 8,786 |
| Moldova | MDA | 1,659 | 4,516 | 2,768 |
| Poland | POL | 2,636 | 9,251 | 16,455 |
| Romania | ROU | 1,659 | 8,896 | 11,793 |
| Serbia and Montenegro | SAM | 1,515 | 10,474 | 7,130 |
| Slovak Republic | SVK | 1,942 | 12,647 | 20,515 |
| Slovenia | SVN | 3,184 | 17,986 | 27,197 |
| **Comparators, Europe & West/Central/South Asia** | | | | |
| Austria | AUT | 4,343 | 24,111 | 36,193 |
| Finland | FIN | 4,735 | 22,064 | 33,626 |
| Greece | GRC | 3,810 | 17,045 | 26,900 |
| India | IND | 930 | 1,159 | 2,781 |
| Ireland | IRL | 4,069 | 15,246 | 38,955 |
| Italy | ITA | 4,568 | 22,569 | 28,168 |
| Norway | NOR | 5,770 | 31,440 | 48,557 |
| Pakistan | PAK | 930 | 1,569 | 2,317 |
| Portugal | PRT | 2,418 | 14,625 | 21,962 |
| Spain | ESP | 2,488 | 18,240 | 28,340 |
| Sri Lanka | LKA | 1,715 | 1,877 | 4,150 |
| Turkey | TUR | 2,219 | 7,642 | 12,406 |
| **Comparators, Other** | | | | |
| Argentina | ARG | 5,677 | 8,499 | 13,276 |
| Brazil | BRA | 1,720 | 7,519 | 9,583 |
| Chile | CHL | 4,378 | 5,948 | 13,394 |
| Colombia | COL | 2,409 | 5,784 | 8,250 |
| Costa Rica | CRI | 2,479 | 6,016 | 10,367 |
| Ecuador | ECU | 1,790 | 5,565 | 7,251 |
| El Salvador | SLV | 1,465 | 3,577 | 6,275 |
| Guatemala | GTM | 3,036 | 3,254 | 4,365 |
| Honduras | HND | 1,463 | 2,695 | 3,636 |
| Indonesia | IDN | 1,540 | 1,749 | 3,570 |
| Jamaica | JAM | 1,338 | 5,388 | 7,344 |
| Japan | JPN | 3,186 | 23,665 | 31,307 |
| Korea, Rep. | KOR | 2,149 | 9,977 | 25,517 |
| Malaysia | MYS | 1,801 | 5,884 | 12,930 |
| Mexico | MEX | 2,471 | 9,497 | 12,932 |
| Myanmar | MMR | 1,086 | 1,042 | 4,275 |
| Nicaragua | NIC | 1,449 | 2,006 | 2,494 |
| Paraguay | PRY | 2,606 | 3,872 | 4,352 |

| | | | | |
|---|---|---|---|---|
| Peru | PER | 2,650 | 5,573 | 7,967 |
| Philippines | PHL | 1,965 | 2,453 | 3,382 |
| Taiwan | TWN | 1,732 | 12,544 | 30,476 |
| Uruguay | URY | 4,764 | 7,296 | 11,675 |

**Notes to Tables 1a and 1b**

All figures are in US $2005 international dollars. 1913 and 1937 GDP per capita are from Maddison (2009) in US $1990, converted to US $2005 using US GDP in 1990 from Maddison (in $1990) and World Bank WDI (in $2005), except for selected TE countries, which are from Broadberry and Klein (2008), also in US $1990 and converted to US $2005. 1988 and 2008 derive from World Bank WDI, in turn derived from the ICP Project.

Various figures for 1913, 1937 and 1988 are estimates by the authors. See Appendix Notes A1 for details.

The 1913 NTE sample consists of all NTEs in Maddison with an estimated GDP per capita in 1913 of no more than 20% more (in log terms) than the richest TE country (Russia, source Broadberry-Klein; see Appendix for further details). China was also excluded. No lower limit was used.

The 1937 NTE sample consists of all NTEs in Maddison with an estimated GDP per capita in 1937 of at most 20% more (in log terms) than the richest TE country (Estonia and Latvia, estimated to have the same GDP per capita as Finland; see Appendix for further details). China was also excluded. No lower limit was used.

**Table 2a: Regression-based estimates of the impact of planning on long-run development**

| Ref year | End year | Sample | $925 | $1,200 | $2,125 | $4,750 | #Obs: TEs/NTEs/All |
|---|---|---|---|---|---|---|---|
| 1913 | 1988 | All | 0.53 | | –0.56* | | 11 / 35 / 46 |
| 1913 | 1988 | E & WCSA | 1.02** | | –0.46 | | 11 / 13 / 24 |
| 1937 | 1988 | All | | 0.93** | | –0.14 | 16 / 34 / 50 |
| 1937 | 1988 | E & WCSA | | 1.01** | | –0.57** | 16 / 12 / 28 |
| 1913 | 2008 | All | –0.07 | | –0.72** | | 11 / 35 / 46 |
| 1913 | 2008 | E & WCSA | 0.56 | | –0.63* | | 11 / 13 / 24 |
| 1937 | 2008 | All | | 0.44 | | –0.07 | 16 / 34 / 50 |
| 1937 | 2008 | E & WCSA | | 0.49* | | –0.54** | 16 / 12 / 28 |

*=sig at 10%
**=sig at 5%

**Notes to Tables 2a and 2b**

The values chosen for $\boldsymbol{Y}$ correspond to the min and max GDP per capita at PPP in 2005 $US for the early and late TE adopters.

Min TE GDP per capita in 1913: $925 (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, calibrated to Maddison estimate of India.)

Max TE GDP per capita in 1913: $2,135 (Russia, source Broadberry-Klein. NB: Maddison estimate for total FSU in 1913 = $2,047.)

Min TE GDP per capita in 1937: $1,202 (Macedonia, based on Maddison 1937 estimate for Yugoslavia and 1953 relative social product per head for the separate Yugoslav republics).

Max TE GDP per capita in 1937: $4,735 (Estonia and Latvia, calibrated to Maddison estimate for Finland and NEBI yearbook assessment of prewar living standards.)

E & WCSA = NTE sample includes Europe and West/Central/South Asia only.

See Appendix Notes A1 for notes on the data

**Table 2b: Regression estimates for Table 2a and Figure 1**

| | Full sample, 1913-1988 | EWCSA only, 1913-1988 | Full sample 1937-1988 | EWCSA only, 1937-1988 |
|---|---|---|---|---|
| $Ln(GDP_{t1})$ | 2.219*** | 2.678*** | 1.409*** | 1.782*** |
| | (0.457) | (0.405) | (0.204) | (0.129) |
| $TE*Ln(GDP_{t1})$ | -1.313** | -1.771*** | -0.782** | -1.155*** |
| | (0.583) | (0.554) | (0.316) | (0.281) |
| TE | 9.501** | 13.113*** | 6.476** | 9.203*** |
| | (4.248) | (3.950) | (2.486) | (2.272) |
| Constant | -7.553** | -11.165*** | -2.193 | -4.920*** |
| | (3.324) | (2.817) | (1.576) | (1.094) |
| R-squared | 0.438 | 0.650 | 0.568 | 0.761 |
| N | 46 | 24 | 50 | 28 |
| | Full sample, 1913-2008 | EWCSA only, 1913-2008 | Full sample 1937-2008 | EWCSA only, 1937-2008 |
| $Ln(GDP_{t1})$ | 1.875*** | 2.534*** | 1.281*** | 1.659*** |
| | (0.473) | (0.393) | (0.185) | (0.108) |
| $TE*Ln(GDP_{t1})$ | -0.790 | -1.449* | -0.366 | -0.745*** |
| | (0.735) | (0.709) | (0.288) | (0.253) |
| TE | 5.326 | 10.456* | 3.036 | 5.768*** |
| | (5.420) | (5.177) | (2.271) | (2.036) |
| Constant | -4.587 | -9.718*** | -0.690 | -3.422*** |
| | (3.431) | (2.740) | (1.429) | (0.896) |
| R-squared | 0.347 | 0.599 | 0.509 | 0.777 |
| N | 46 | 24 | 50 | 28 |

* p<0.10, ** p<0.05, *** p<0.01

Heteroskedastic-robust standard errors in parentheses.

**Table 3. Transition/Non-transition economy gaps in stocks of physical infrastructure and secondary school enrolment, 1988 and 2008**

| Physical infrastructure and human capital | Low income TE $ | NTE | TE | Difference | High income TE $ | NTE | TE | Difference | Countries |
|---|---|---|---|---|---|---|---|---|---|
| End of Planning: 1988 | | | | | | | | | |
| Log rail route km per capita | 3,154 | -8.87 | -8.20 | 0.66** | 17,986 | -7.92 | -7.09 | 0.83** | 79 |
| Log tel. lines per 10,000 pop | 2,004 | -4.62 | -2.93 | 1.69** | 17,986 | -1.44 | -1.79 | -0.35* | 185 |
| Log electr. gen. cap. GW per capita | 2,004 | -16.42 | -14.34 | 2.08** | 17,986 | -13.67 | -13.59 | 0.08 | 165 |
| Percent enrolment in secondary school | 2,004 | 36.02 | 101.97 | 65.95** | 17,986 | 81.57 | 88.86 | 7.29* | 122 |
| Transition: 2008 | | | | | | | | | |
| Log rail route km per capita | 1,781 | -9.73 | -8.96 | 0.77** | 27,197 | -8.07 | -6.98 | 1.09** | 100 |
| Log tel. lines per 10,000 pop | 1,781 | -3.93 | -2.39 | 1.54** | 27,197 | -0.92 | -0.91 | 0.01 | 199 |
| Log electr. gen. cap. GW per capita | 1,781 | -16.67 | -14.62 | 2.06** | 27,197 | -13.43 | -13.41 | 0.02 | 178 |
| Percent enrolment in secondary school | 1,781 | 49.14 | 87.68 | 38.54** | 27,197 | 101.93 | 95.84 | -6.09* | 152 |

Source: As for Figure 1.
* = significant at 5%
** = significant at 1%
"Low income TE $" = GDP per capita in PPP $2005 of lowest-income TE country in estimation sample.
"High income TE $" = GDP per capita in PPP $2005 of highest-income TE country in estimation sample.

**Table 4. Summary statistics**

| | ALL | NTE | TE | of which: 2002-05 (BEEPS II & III) | of which: 2007-09 (BEEPS IV) |
|---|---|---|---|---|---|
| **Country characteristics:** | | | | | |
| Log GDP pc | 8.43 | 8.32 | 9.00 | 8.87 | 9.17 |
| GDP pc (exp(log)) | 4,580 | 4,085 | 8,106 | 7,130 | 9,563 |
| **Sample sizes:** | | | | | |
| N firms | 62,032 | 51,677 | 10,355 | 5,832 | 4,523 |
| N countries | 111 | 83 | 28 | 28 | 27 |
| N surveys | 202 | 113 | 89 | 61 | 28 |
| **Firm characteristics:** | | | | | |
| Log L | 3.55 | 3.54 | 3.55 | 3.42 | 3.73 |
| L (exp(log)) | 34.7 | 34.6 | 34.9 | 30.4 | 41.6 |
| foreign (1/0) | 0.120 | 0.115 | 0.146 | 0.160 | 0.129 |
| exporter (1/0) | 0.291 | 0.281 | 0.342 | 0.335 | 0.350 |
| importer (1/0) | 0.249 | 0.232 | 0.331 | 0.330 | 0.334 |
| small city (1/0) | 0.675 | 0.672 | 0.691 | 0.661 | 0.729 |
| Constraints (0-4): | | | | | |
| Electricity | 1.48 | 1.56 | 1.11 | 0.65 | 1.70 |
| Telecoms | 0.68 | 0.72 | 0.47 | 0.47 | 0.00 |
| Transport | 0.94 | 0.96 | 0.83 | 0.59 | 1.14 |
| Access Land | 0.85 | 0.84 | 0.88 | 0.67 | 1.14 |
| Inad Educ Labor | 1.22 | 1.18 | 1.41 | 1.09 | 1.82 |
| Macro Instability | 1.90 | 1.93 | 1.77 | 1.77 | 0.00 |
| Gov Policy Unc | 1.62 | 1.59 | 1.78 | 1.78 | 0.00 |
| Political Instability | 1.67 | 1.64 | 1.83 | 0.00 | 1.83 |
| Tax Administration | 1.42 | 1.39 | 1.59 | 1.62 | 1.56 |
| Labour Reg | 1.00 | 1.00 | 1.01 | 0.98 | 1.05 |
| Customs | 0.99 | 0.96 | 1.11 | 1.19 | 1.00 |
| Bus Licensing | 0.96 | 0.93 | 1.10 | 1.05 | 1.15 |
| Courts | 0.95 | 0.87 | 1.25 | 1.19 | 1.33 |
| Corruption | 1.57 | 1.59 | 1.49 | 1.29 | 1.72 |
| Crime Theft Disorder | 1.15 | 1.16 | 1.09 | 0.94 | 1.28 |

Notes: Means of GDP and L in levels are exp(mean(log(X)).

**Table 5. BEEPS II & III (2002; 2005) and non-transition economies**

| | Levels (> or < 1.1) | | | | Differences (>0.1 or < -0.1) | |
|---|---|---|---|---|---|---|
| | BEEPS II-III | | NTEs | | BEEPS vs. NTEs | |
| | **PTE** | **RTE** | **PNTE** | **RNTE** | **DLINC** | **DHINC** |
| Electricity | 0.769* | 0.550* | ***1.567**** | 0.708* | -0.798* | -0.158* |
| Telecoms | 0.492* | 0.438* | 0.672* | 0.418* | -0.180* | 0.020 |
| Transport | 0.566* | 0.576* | 0.918* | 0.538* | -0.352* | 0.038 |
| Access to Land | 0.702* | 0.629* | 0.879* | 0.412* | -0.177* | ***0.217**** |
| Inad. Educated Labor | 0.894* | ***1.149**** | 1.100 | 1.120 | -0.206* | 0.030 |
| Macro Instability | ***1.764**** | ***1.697**** | ***1.856**** | ***2.052**** | -0.092 | -0.356* |
| Gov. Policy Uncertainty | ***1.756**** | ***1.797**** | ***1.574**** | ***1.455**** | ***0.182**** | ***0.342**** |
| Tax Administration | ***1.640**** | ***1.507**** | ***1.340**** | 1.044* | ***0.300**** | ***0.463**** |
| Labor Regulation | 0.740* | ***1.164**** | 0.904* | 1.071* | -0.164* | 0.093 |
| Customs | 1.084 | 0.799* | 0.738* | 0.448* | ***0.345**** | ***0.351**** |
| Bus. Licensing | 1.083 | 0.934* | 0.879* | 0.797* | ***0.204**** | 0.137 |
| Courts | ***1.143**** | ***1.240**** | 0.797* | 0.771* | ***0.346**** | ***0.469**** |
| Corruption | ***1.388**** | ***1.165**** | ***1.524**** | ***1.206**** | -0.135 | -0.040 |
| Crime Theft Disorder | 0.945* | 0.956* | ***1.137**** | 0.975* | -0.192* | -0.018 |

Notes: This table reports tests of constraints across country groups: in the "Levels" columns, the tests are for each group on its own vs. the overall mean constraint level of 1.1. In the "Differences columns", the tests are vs. 0.1 if differences are positive and vs. -0.1 if they are negative.

DLINC = PTE vs PNTE (poor TE vs poor NTE)
DHINC = RTE vs RNTE (rich TE vs rich NTE)

## Table 6. Ranking constraints: BEEPS II & III and NTEs (Poorer countries)

| PTEs | 1 MacroInst | 2 GovPolicy | 3 TaxAdmin | 4 Corruptior | 5 Courts | 6 Customs | 7 BusLicens | 8 CrimeThef | 9 InadEducL | 10 Electricity | 11 LaborReg | 12 AccessLa | 13 Transport | 14 Telecoms |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Macro Instability | 1.76 | | | | | | | | | | | | | |
| Gov Policy Uncertainty | | 1.76 | | | | | | | | | | | | |
| Tax Administration | | | 1.64 | | | | | | | | | | | |
| Corruption | ** | ** | ** | 1.39 | | | | | | | | | | |
| Courts | ** | ** | ** | ** | 1.14 | | | | | | | | | |
| Customs | ** | ** | ** | ** | | 1.08 | | | | | | | | |
| Bus Licensing | ** | ** | ** | ** | | | 1.08 | | | | | | | |
| Crime Theft Disorder | ** | ** | ** | ** | ** | | | 0.95 | | | | | | |
| Inad Educ Labor | ** | ** | ** | ** | ** | ** | ** | | 0.89 | | | | | |
| Electricity | ** | ** | ** | ** | ** | ** | ** | ** | | 0.77 | | | | |
| Labor Regulation | ** | ** | ** | ** | ** | ** | ** | ** | ** | | 0.74 | | | |
| Access Land | ** | ** | ** | ** | ** | ** | ** | ** | ** | | | 0.70 | | |
| Transport | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | | 0.57 | |
| Telecoms | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | | 0.49 |

| PNTEs | 1 MacroInst | 2 GovPolicy | 3 Electricity | 4 Corruptior | 5 TaxAdmin | 6 CrimeThef | 7 InadEducL | 8 Transport | 9 LaborReg | 10 AccessLa | 11 BusLicens | 12 Courts | 13 Customs | 14 Telecoms |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MacroInstability | 1.86 | | | | | | | | | | | | | |
| GovPolicyUnc | ** | 1.57 | | | | | | | | | | | | |
| Electricity | ** | | 1.57 | | | | | | | | | | | |
| Corruption | ** | | | 1.52 | | | | | | | | | | |
| TaxAdministration | ** | ** | ** | ** | 1.34 | | | | | | | | | |
| CrimeTheftDisorder | ** | ** | ** | ** | ** | 1.14 | | | | | | | | |
| InadEducLabor | ** | ** | ** | ** | ** | | 1.10 | | | | | | | |
| Transport | ** | ** | ** | ** | ** | ** | ** | 0.92 | | | | | | |
| LaborReg | ** | ** | ** | ** | ** | ** | ** | | 0.90 | | | | | |
| AccessLand | ** | ** | ** | ** | ** | ** | ** | | | 0.88 | | | | |
| BusLicensing | ** | ** | ** | ** | ** | ** | ** | | | | 0.88 | | | |
| Courts | ** | ** | ** | ** | ** | ** | ** | ** | | | | 0.80 | | |
| Customs | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | | 0.74 | |
| Telecoms | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | | 0.67 |

## Table 6. Ranking constraints: BEEPS II & III and NTEs (cont.) (Richer countries)

| RTEs | 1 GovPolicy | 2 MacroInst | 3 TaxAdmin | 4 Courts | 5 Corruptio | 6 LaborReg | 7 InadEducL | 8 CrimeThef | 9 BusLicens | 10 Customs | 11 AccessLa | 12 Transport | 13 Electricity | 14 Telecoms |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gov Policy Uncertainty | 1.80 | | | | | | | | | | | | | |
| Macro Instability | | 1.70 | | | | | | | | | | | | |
| TaxAdministration | ** | ** | 1.51 | | | | | | | | | | | |
| Courts | ** | ** | ** | 1.24 | | | | | | | | | | |
| Corruption | ** | ** | ** | | 1.17 | | | | | | | | | |
| LaborReg | ** | ** | ** | | | 1.16 | | | | | | | | |
| InadEducLabor | ** | ** | ** | | | | 1.15 | | | | | | | |
| CrimeTheftDisorder | ** | ** | ** | ** | ** | ** | ** | 0.96 | | | | | | |
| BusLicensing | ** | ** | ** | ** | ** | ** | ** | | 0.93 | | | | | |
| Customs | ** | ** | ** | ** | ** | ** | ** | * | | 0.80 | | | | |
| AccessLand | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | 0.63 | | | |
| Transport | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | | 0.58 | | |
| Electricity | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | | | 0.55 | |
| Telecoms | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | * | | 0.44 |

| RNTEs | 1 MacroInst | 2 GovPolicy | 3 Corruptior | 4 InadEducL | 5 LaborReg | 6 TaxAdmin | 7 CrimeThef | 8 BusLicens | 9 Courts | 10 Electricity | 11 Transport | 12 Customs | 13 Telecoms | 14 AccessLa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MacroInstability | 2.05 | | | | | | | | | | | | | |
| GovPolicyUnc | ** | 1.45 | | | | | | | | | | | | |
| Corruption | ** | ** | 1.21 | | | | | | | | | | | |
| InadEducLabor | ** | ** | | 1.12 | | | | | | | | | | |
| LaborReg | ** | ** | ** | | 1.07 | | | | | | | | | |
| TaxAdministration | ** | ** | ** | | | 1.04 | | | | | | | | |
| CrimeTheftDisorder | ** | ** | ** | ** | | | 0.97 | | | | | | | |
| BusLicensing | ** | ** | ** | ** | ** | ** | ** | 0.80 | | | | | | |
| Courts | ** | ** | ** | ** | ** | ** | ** | | 0.77 | | | | | |
| Electricity | ** | ** | ** | ** | ** | ** | ** | | | 0.71 | | | | |
| Transport | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | 0.54 | | | |
| Customs | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | | 0.45 | | |
| Telecoms | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | | | 0.42 | |
| AccessLand | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | * | | | 0.41 |

**Table 7. BEEPS IV (2008) and non-transition economies**

| | Levels (> or < 1.1) | | | | Differences (>0.1 or < -0.1) | | | |
|---|---|---|---|---|---|---|---|---|
| | BEEPS II-III | | BEEPS IV | | BEEPS II-III vs. NTEs | | BEEPS IV vs. NTEs | |
| | **PTE** | **RTE** | **PTE** | **RTE** | **DLINC** | **DHINC** | **DLINC** | **DHINC** |
| Electricity | 0.769* | 0.550* | ***1.981**** | ***1.554**** | -0.798* | -0.158* | ***0.414**** | ***0.846**** |
| Telecoms | 0.492* | 0.438* | n.a. | n.a. | -0.180* | 0.020 | n.a. | n.a. |
| Transport | 0.566* | 0.576* | 1.156 | 1.079 | -0.352* | 0.038 | ***0.239**** | ***0.542**** |
| Access to Land | 0.702* | 0.629* | ***1.253**** | 1.093 | -0.177* | ***0.217**** | ***0.374**** | ***0.681**** |
| Inad. Educated Labor | 0.894* | ***1.149**** | ***1.806**** | ***1.672**** | -0.206* | 0.030 | ***0.706**** | ***0.553**** |
| PoliticalInstability | n.a. | n.a. | ***2.041**** | ***1.721**** | n.a. | n.a. | ***0.445**** | -0.126 |
| Tax Administration | ***1.640**** | ***1.507**** | ***1.441**** | ***1.532**** | ***0.300**** | ***0.463**** | 0.101 | ***0.488**** |
| Labor Regulation | 0.740* | ***1.164**** | 0.749* | 1.087 | -0.164* | 0.093 | -0.155 | 0.017 |
| Customs | 1.084 | 0.799* | 1.034 | 0.637* | ***0.345**** | ***0.351**** | ***0.296**** | ***0.189**** |
| Bus. Licensing | 1.083 | 0.934* | 1.143 | 1.107 | ***0.204**** | 0.137 | ***0.264**** | ***0.310**** |
| Courts | ***1.143**** | ***1.240**** | ***1.336**** | ***1.273**** | ***0.346**** | ***0.469**** | ***0.538**** | ***0.502**** |
| Corruption | ***1.388**** | ***1.165**** | ***1.939**** | ***1.589**** | -0.135 | -0.040 | ***0.415**** | ***0.384**** |
| Crime Theft Disorder | 0.945* | 0.956* | ***1.648**** | ***1.157**** | -0.192* | -0.018 | ***0.511**** | ***0.182**** |

Notes: This table reports tests of constraints across country groups: in the "Levels" columns, the tests are for each group on its own vs. the overall mean constraint level of 1.1. In the "Differences columns", the tests are vs. 0.1 if differences are positive and vs. -0.1 if they are negative.

DLINC = PTE vs PNTE (poor TE vs poor NTE)
DHINC = RTE vs RNTE (rich TE vs rich NTE)

**Table 8. Ranking constraints: BEEPS IV and NTEs (Poorer countries)**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PTEs** | **PoliticalIn** | **Electricity** | **Corruptior** | **InadEducL** | **CrimeThef** | **TaxAdmin** | **Courts** | **AccessLar** | **Transport** | **BusLicens** | **Customs** | **LaborReg** |
| **Political Instability** | **2.04** | | | | | | | | | | | |
| **Electricity** | | **1.98** | | | | | | | | | | |
| **Corruption** | | | **1.94** | | | | | | | | | |
| **InadEducLabor** | ** | | | **1.81** | | | | | | | | |
| **CrimeTheftDisorder** | ** | ** | ** | | **1.65** | | | | | | | |
| **TaxAdministration** | ** | ** | ** | ** | * | **1.44** | | | | | | |
| **Courts** | ** | ** | ** | ** | ** | | **1.34** | | | | | |
| **AccessLand** | ** | ** | ** | ** | ** | | | **1.25** | | | | |
| **Transport** | ** | ** | ** | ** | ** | ** | | | **1.16** | | | |
| **BusLicensing** | ** | ** | ** | ** | ** | ** | * | | | **1.14** | | |
| **Customs** | ** | ** | ** | ** | ** | ** | ** | * | | | **1.03** | |
| **LaborReg** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | **0.75** |

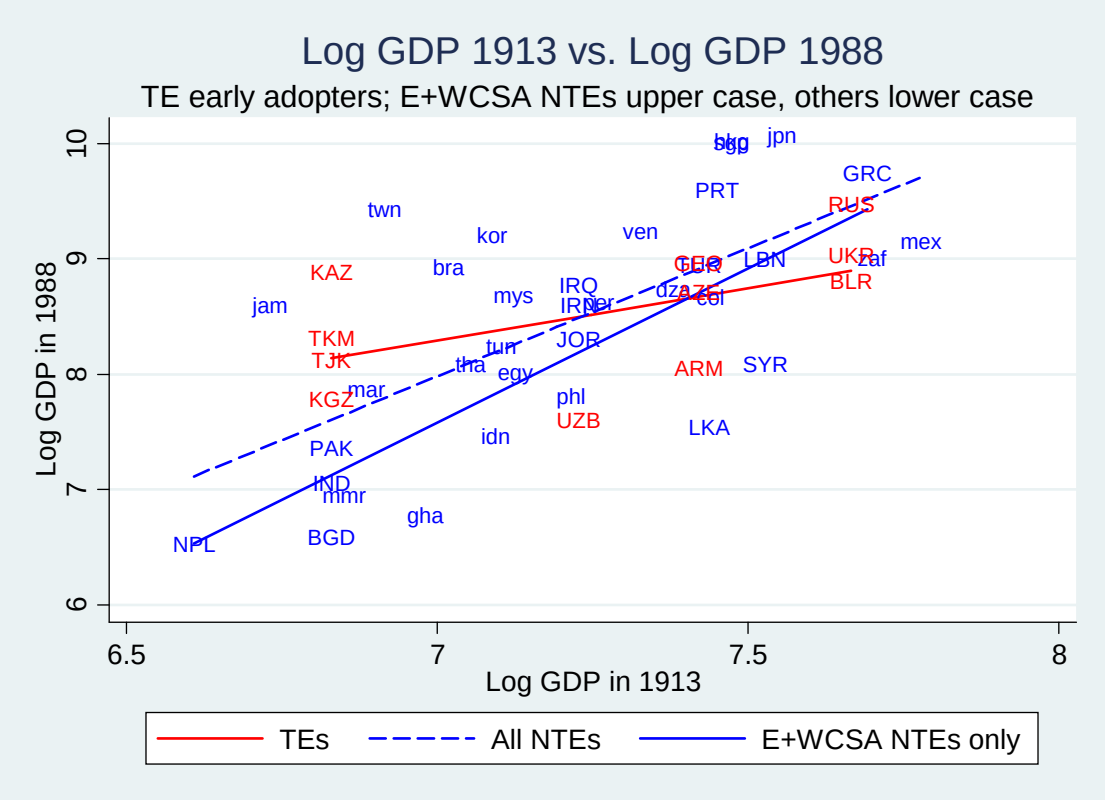
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PNTEs** | **PoliticalIn** | **Electricity** | **Corruptior** | **TaxAdmin** | **CrimeThef** | **InadEducL** | **Transport** | **LaborReg** | **AccessLar** | **BusLicens** | **Courts** | **Customs** |
| **PoliticalInstability** | **1.60** | | | | | | | | | | | |
| **Electricity** | | **1.57** | | | | | | | | | | |
| **Corruption** | | | **1.52** | | | | | | | | | |
| **TaxAdministration** | ** | ** | ** | **1.34** | | | | | | | | |
| **CrimeTheftDisorder** | ** | ** | ** | ** | **1.14** | | | | | | | |
| **InadEducLabor** | ** | ** | ** | ** | | **1.10** | | | | | | |
| **Transport** | ** | ** | ** | ** | ** | ** | **0.92** | | | | | |
| **LaborReg** | ** | ** | ** | ** | ** | ** | | **0.90** | | | | |
| **AccessLand** | ** | ** | ** | ** | ** | ** | | | **0.88** | | | |
| **BusLicensing** | ** | ** | ** | ** | ** | ** | | | | **0.88** | | |
| **Courts** | ** | ** | ** | ** | ** | ** | ** | | | | **0.80** | |
| **Customs** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | | **0.74** |

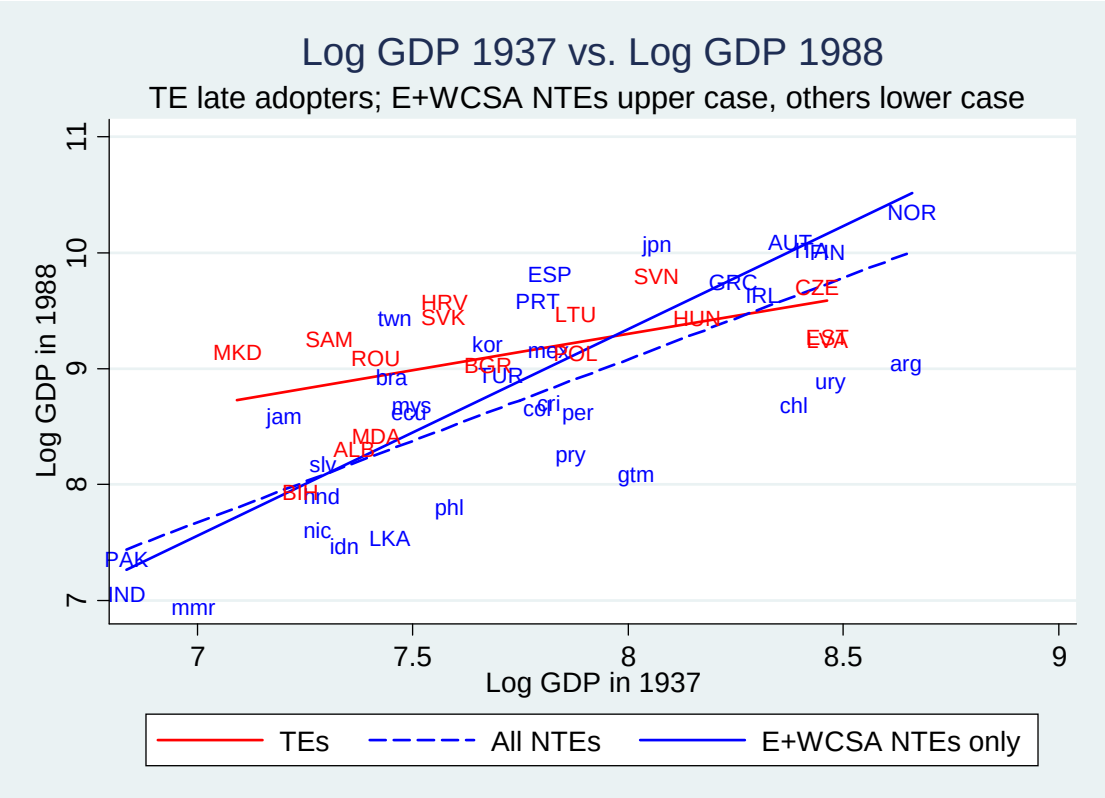
**Table 8. Ranking constraints: BEEPS IV and NTEs (cont.) (Richer countries)**

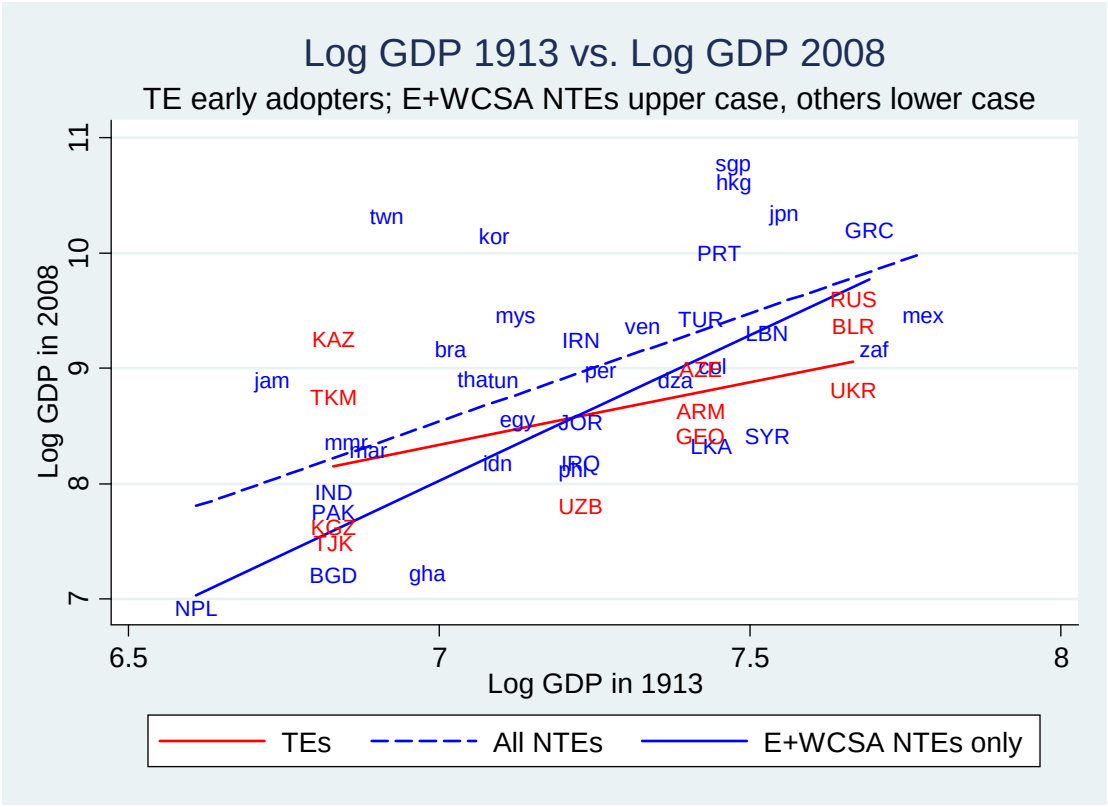
| RTEs | 1 PoliticalIn | 2 InadEducL | 3 Corruptior | 4 Electricity | 5 TaxAdmin | 6 Courts | 7 CrimeThef | 8 BusLicens | 9 AccessLa | 10 LaborReg | 11 Transport | 12 Customs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PoliticalInstability | 1.72 | | | | | | | | | | | |
| InadEducLabor | | 1.67 | | | | | | | | | | |
| Corruption | | | 1.59 | | | | | | | | | |
| Electricity | | | | 1.55 | | | | | | | | |
| TaxAdministration | ** | | | | 1.53 | | | | | | | |
| Courts | ** | ** | ** | ** | ** | 1.27 | | | | | | |
| CrimeTheftDisorder | ** | ** | ** | ** | ** | | 1.16 | | | | | |
| BusLicensing | ** | ** | ** | ** | ** | * | | 1.11 | | | | |
| AccessLand | ** | ** | ** | ** | ** | * | | | 1.09 | | | |
| LaborReg | ** | ** | ** | ** | ** | ** | | | | 1.09 | | |
| Transport | ** | ** | ** | ** | ** | ** | | | | | 1.08 | |
| Customs | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | 0.64 |

| RNTEs | 1 PoliticalIn | 2 Corruptior | 3 InadEducL | 4 LaborReg | 5 TaxAdmin | 6 CrimeThef | 7 BusLicens | 8 Courts | 9 Electricity | 10 Transport | 11 Customs | 12 AccessLar |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PoliticalInstability | 1.85 | | | | | | | | | | | |
| Corruption | ** | 1.21 | | | | | | | | | | |
| InadEducLabor | ** | | 1.12 | | | | | | | | | |
| LaborReg | ** | ** | | 1.07 | | | | | | | | |
| TaxAdministration | ** | ** | | | 1.04 | | | | | | | |
| CrimeTheftDisorder | ** | ** | ** | | | 0.97 | | | | | | |
| BusLicensing | ** | ** | ** | ** | ** | ** | 0.80 | | | | | |
| Courts | ** | ** | ** | ** | ** | ** | | 0.77 | | | | |
| Electricity | ** | ** | ** | ** | ** | ** | | | 0.71 | | | |
| Transport | ** | ** | ** | ** | ** | ** | ** | ** | ** | 0.54 | | |
| Customs | ** | ** | ** | ** | ** | ** | ** | ** | ** | | 0.45 | |
| AccessLand | ** | ** | ** | ** | ** | ** | ** | ** | ** | * | | 0.41 |

**Figure 1. Long-run growth for economies exposed and not exposed to Soviet-style planning**




Log GDP 1913 vs. Log GDP 2008
TE early adopters; E+WCSA NTEs upper case, others lower case
Log GDP in 2008
11
10
9
8
7
6.5
7
7.5
8
Log GDP in 1913
sgp
hkg
twn
jpn
GRC
kor
PRT
RUS
mys
ven
TUR
BLR
mex
KAZ
bra
IRN
LBN
zaf
jam
thatun
per
col
UKR
TKM
egy
JOR
ARM
mmr
GEO
SYR
LKA
idn
IRQ
phl
IND
UZB
PAK
KGZ
TJK
BGD
gha
NPL
TEs
All NTEs
E+WCSA NTEs only

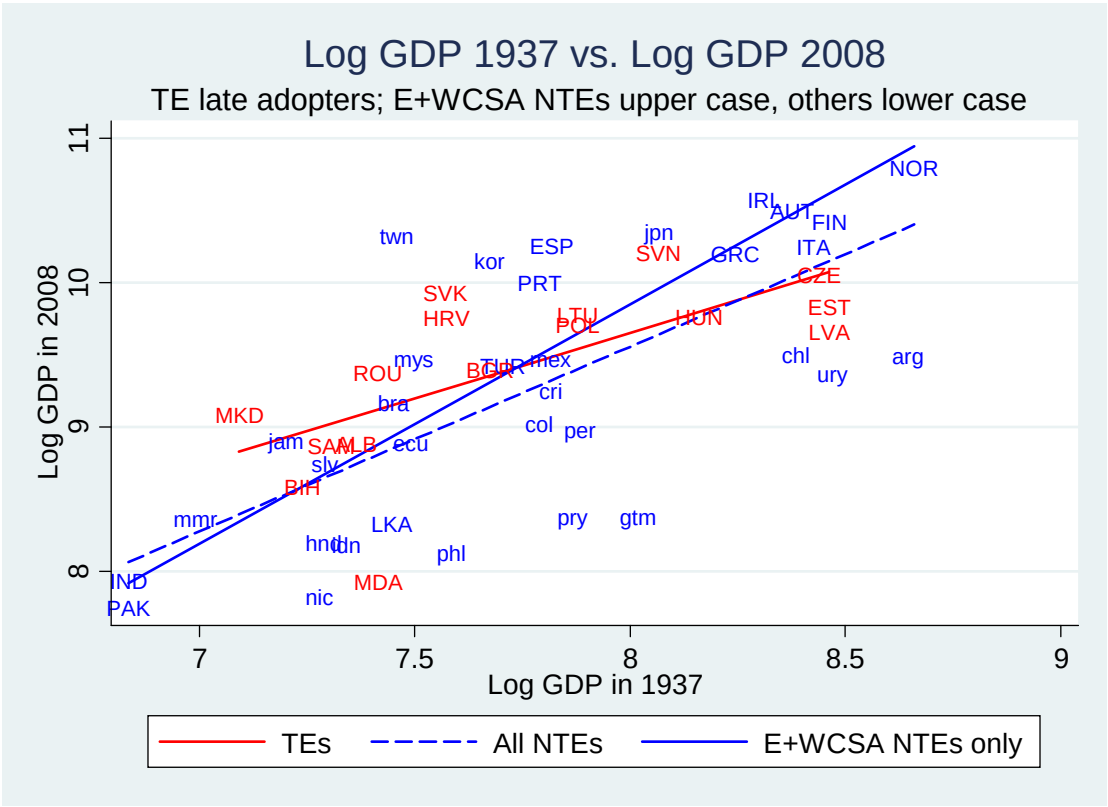
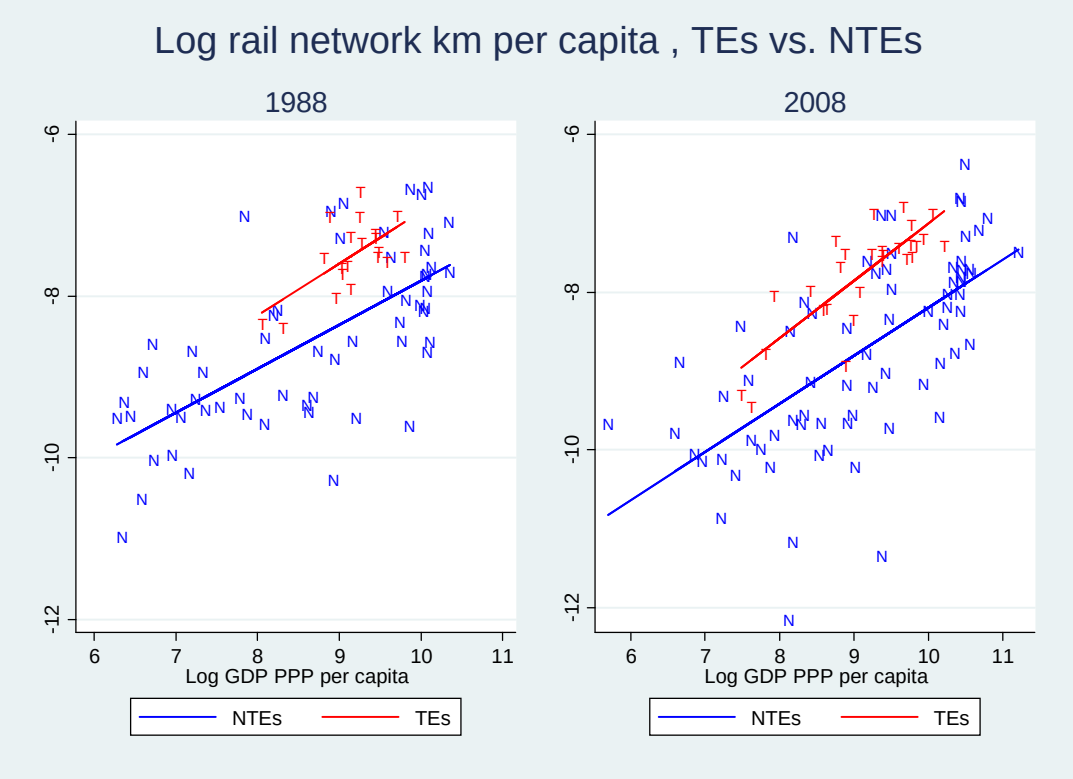

Log GDP 1937 vs. Log GDP 2008
TE late adopters; E+WCSA NTEs upper case, others lower case
Log GDP in 2008
11
10
9
8
7
7.5
8
8.5
9
Log GDP in 1937
NOR
IRL
AUT
FIN
twn
jpn
ESP
SVN
GRC
ITA
kor
CZE
PRT
SVK
EST
HRV
LVA
chl
arg
ury
mys
ROU
cri
MKD
bra
col
per
jam
ecu
slv
BIH
mmr
LKA
pry
gtm
hnd
idn
phl
IND
MDA
PAK
nic
TEs
All NTEs
E+WCSA NTEs only

**Figure 2. Levels of physical infrastructure and schooling – transition and non-transition economies, 1988 and 2008**



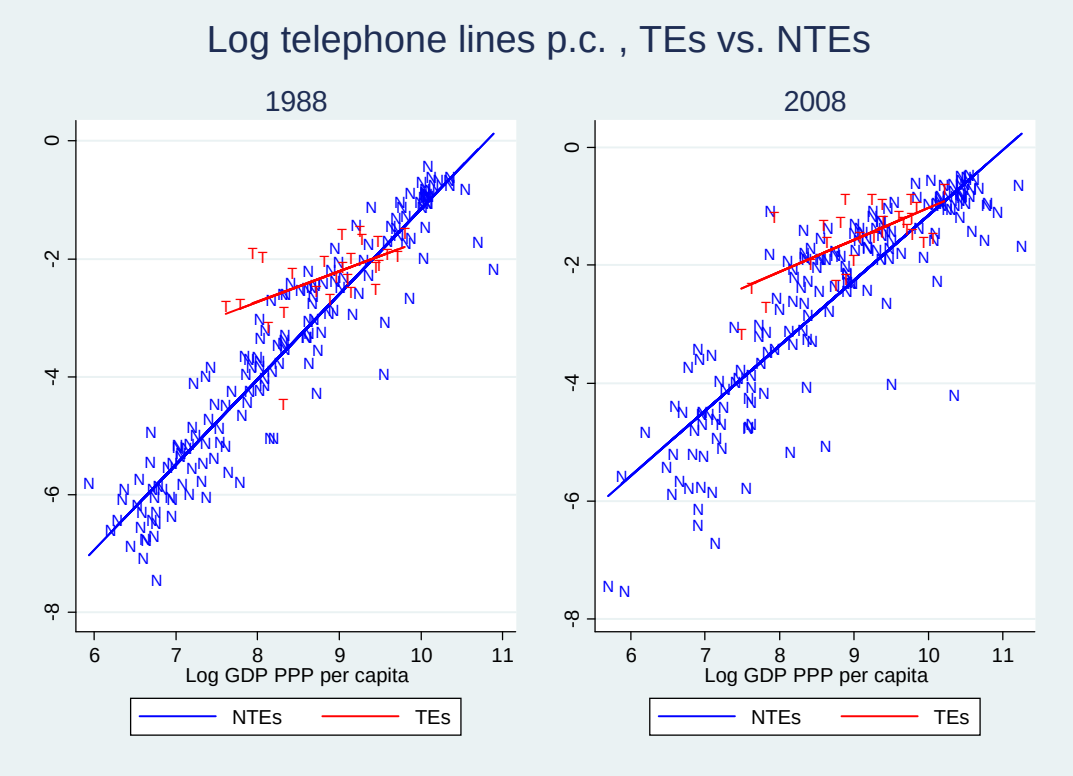
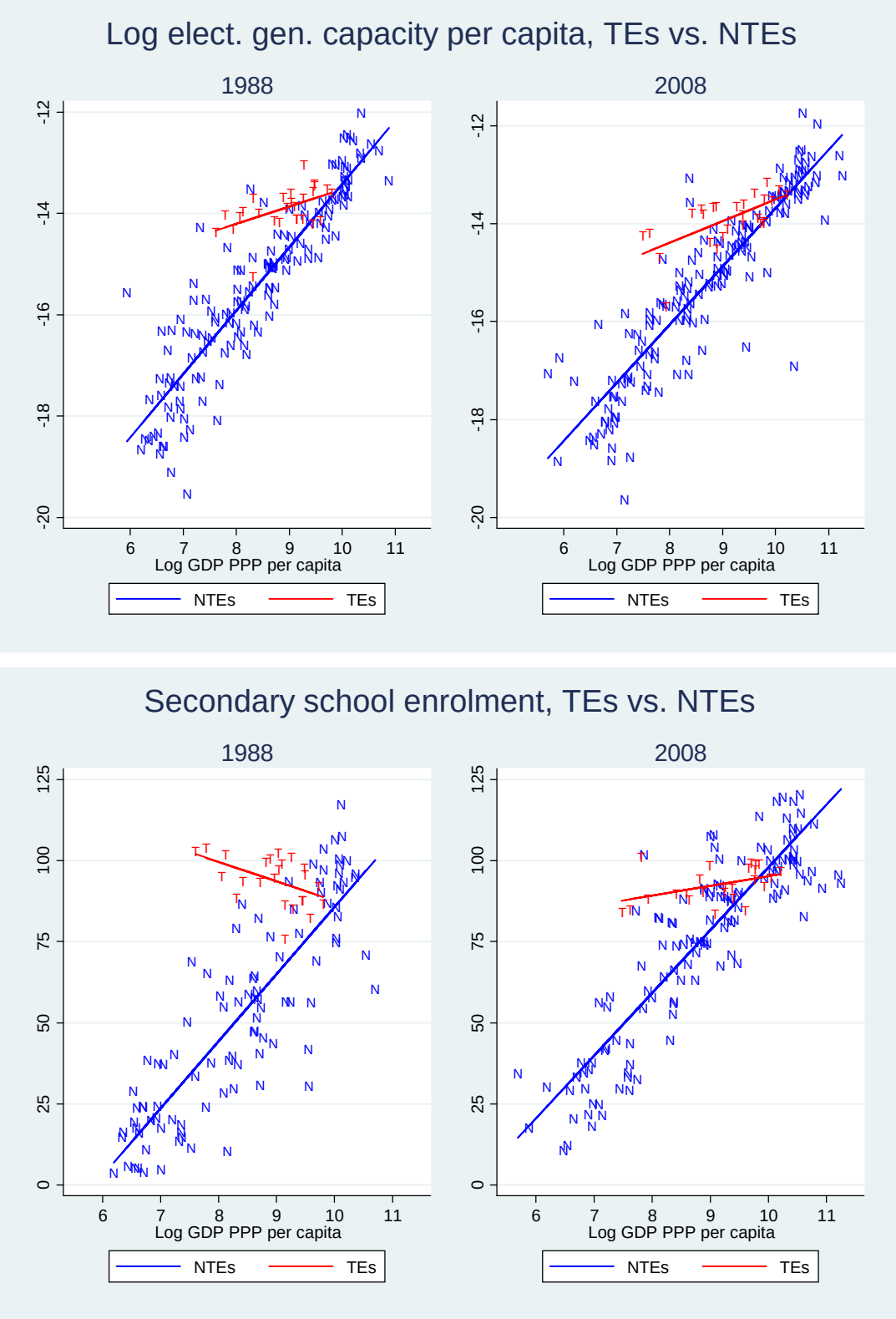



**Figure 2. Levels of physical infrastructure and schooling – transition and non-transition economies, 1988 and 2008 (cont.)**




Source: World Bank, *World Development Indicators*, except electricity generation capacity, which is from the US Energy Information Administration

**Fig. 3a Measures of the business environment (institutions), transition and non-transition countries**

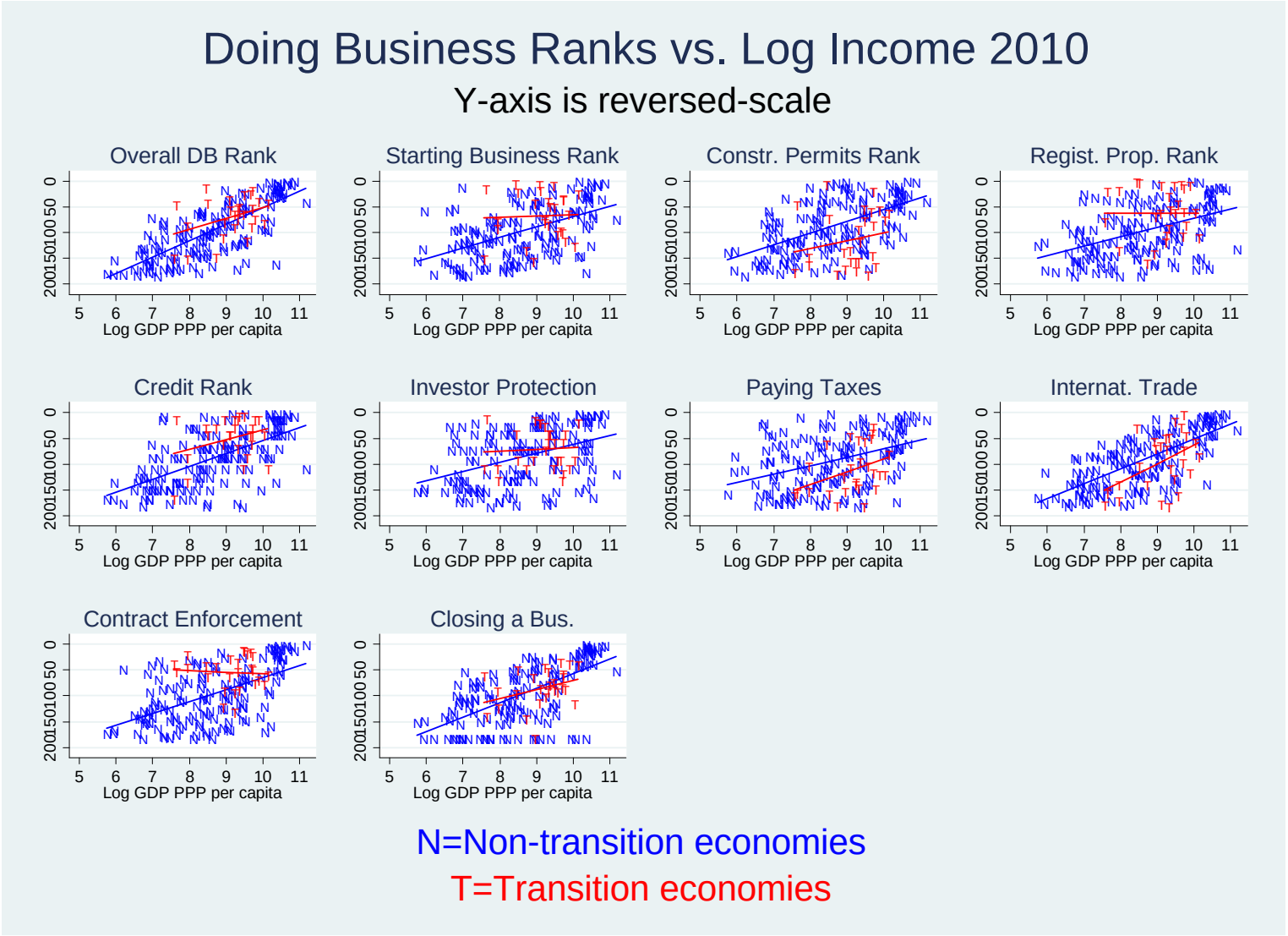
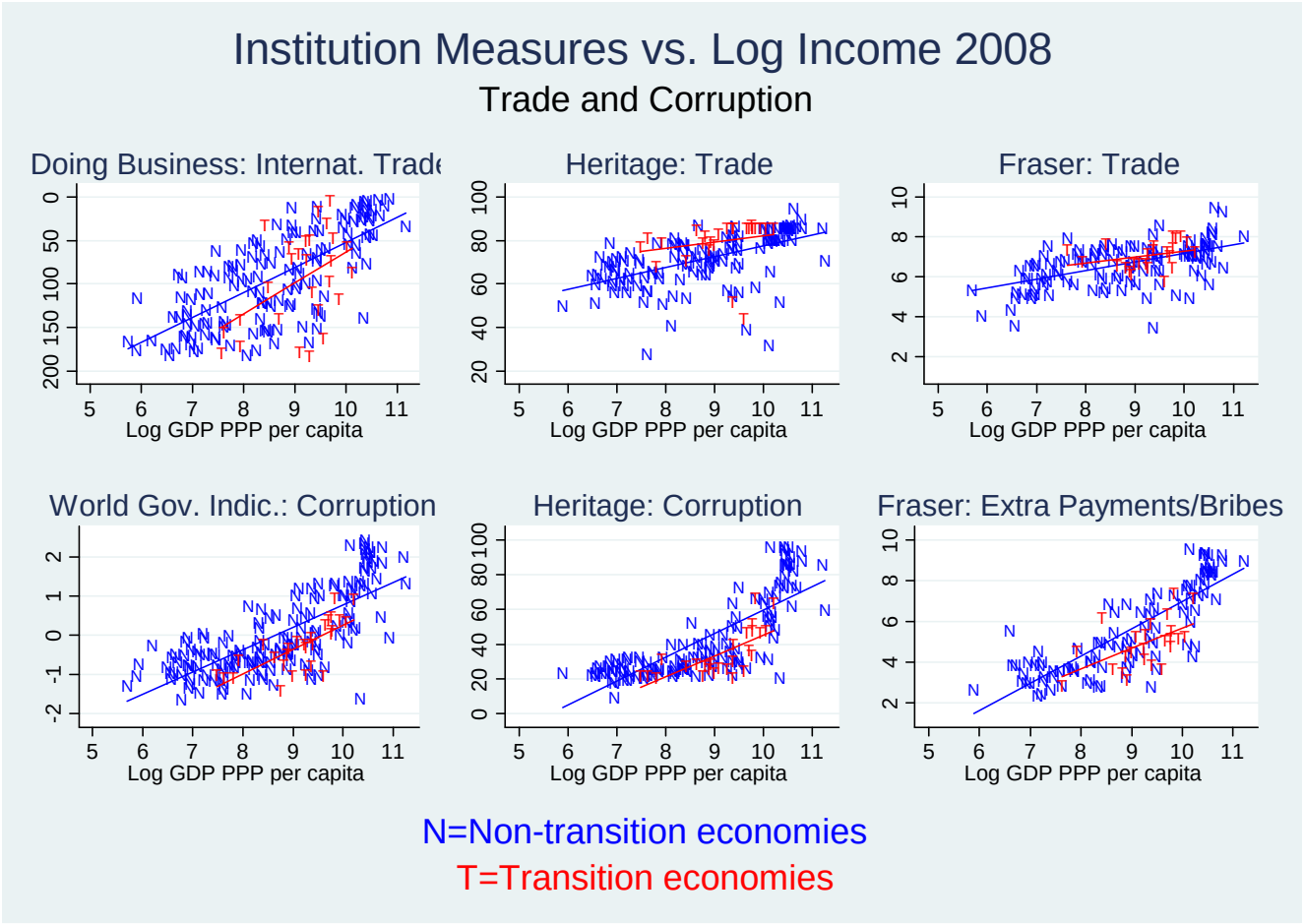
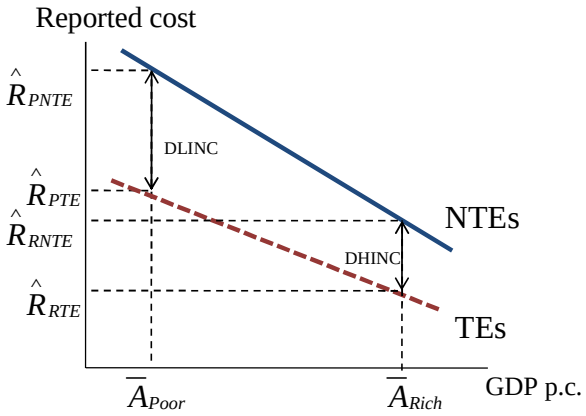


**Fig. 3b Measures of the business environment (institutions), transition and non-transition countries**

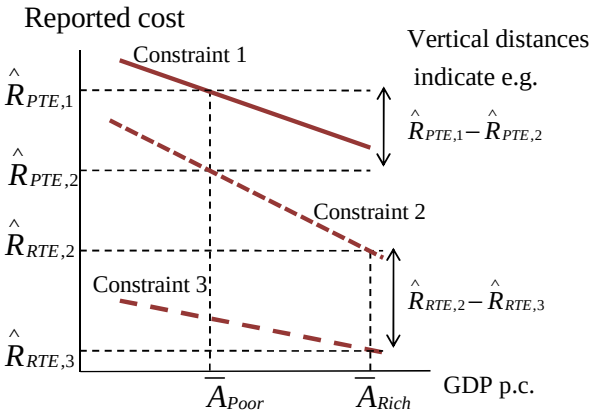



Sources: See Table A1

**Figure 4. Testing differences in reported costs (a) by country type and income level and (b) constraint type**




a. The downward sloping line is the income-reported cost locus (18) for one constraint: solid line is NTEs and dashed line is TEs.




b. Downward sloping lines are the income-reported cost loci (18) for three different constraints in TEs.

## APPENDIX

## NOTES A1

### Country data notes for Section 2 and Tables 1a, 1b and 2.

GDP per capita in 1988 and 2005 is at PPP in 2005 $US from World Bank WDIs except as noted.

GDP per capita in 1913 and 1937 is from Maddison in 1990 $US, converted to 2005 $US using US GDP in 1990 from Maddison (in $1990) and World Bank WDI (in $2005), except as noted.

Broadberry and Klein (2008) is used for GDP per capita in 1913 in Russia and 1937 in Romania, the latter in preference to Maddison because of the postwar territorial change associated with the separation of Moldova from Romania (Broadberry-Klein refer to the prewar territory of Romania).

*1913 proxies and estimates:*

Ukraine, Belarus: proxy is Russia.
Armenia, Azerbaijan, Georgia: proxy is Turkey.
Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan: proxy is India.
Uzbekistan: proxy is Iran/Iraq.
Bangladesh, Pakistan: proxy is India.

Uzbekistan was more urbanized than the rest of Central Asia in 1926. Hence we proxy Uzbek GDP using Iran rather than India. Source: Henze (1949).

*1937 proxies and estimates:*

Estonia, Latvia: proxy is Finland.
Lithuania: proxy is Poland.
Moldova and Romania: the Broadberry-Klein (2008) estimate for Romania in 1937 is used for both Romania and Moldova.
Czech Republic, Slovakia: Czechoslovakia and Capek-Sazam (1993); see below.
Yugoslav republics: Yugoslavia 1937 and 1953 republic data; see below.
Ecuador and Paraguay is 1939 GDP per capita.
Jamaica is 1938 GDP per capita.
Myanmar is average of 1936 and 1938 GDP per capita.

"The prewar development levels of Estonia and Finland were nearly equal, and by 1939, the Estonian standard of living was approximately on par with - if not slightly higher than - that of Finland, and Latvia was not far behind (Kukk 1991; Lieven 1993)." Source: Hedegaard and Lindström (1998: 15).

Yugoslav republic GDP per capita 1937 is based on Yugoslavia 1937 from Maddison and 1953 relative social product per head in the separate republics in current prices. Source: Gregory (1973).

Czech and Slovak GDP per capita 1937 is based on Czechoslovakia 1937 from Maddison and 1937 relative shares of income and population from Capek and Sazama (1993).

*1988 and 2008 estimates:*

The main source is the World Bank WDI PPP data in 2005 $US. In several cases, 1988 and 2008 figures use as a supplementary source the Conference Board "Total Economy Database" (TED). TED provides two PPP series, one in 2010 "EKS" $US and one in 1990 "GK" $US. The latter is compatible with Maddison's PPP series. TED data below refer to the EKS series except where noted.

Armenia, Belarus, Kazakhstan, Lithuania, Czech Republic, Slovenia, Croatia, Macedonia: WB figure for 1990 backwards chain-linked from TED to obtain 1989; 1988 is set =1989.

Azerbaijan: 1988 based on 1989 WB figure backwards chain-linked from TED.

Russia: 1988 = 1989.

Taiwan, Iraq, Serbia & Montenegro, Bosnia & Herzegovina: TED data converted to 2005 dollars using US 2005 GDP per capita from WB in 2005 $US and TED in 2010 $US.

Serbia & Montenegro: 1988 = 1989.

Bosnia: 1988 and 1989 = 1990.

Poland: WB figure for 1990 backwards chain-linked from TED to obtain 1988.

Myanmar: from TED GK series in 1990 $US converted to 2005 $US using US 1990 GDP per capita from WB in 2005 $US and TED GK data in 1990 $US.

## TABLE A1. Components of aggregate business environment indicators

| World Bank Governance | World Bank Doing Business | Heritage Foundation Economic Freedom | Fraser Institute Economic Freedom |
|---|---|---|---|
| **Broad dimensions of governance or institutional quality** | **Business regulation and the protection of property rights** | **Measures how free individuals are to "work, produce, consume and invest … both protected by the state and unconstrained by the state"** | **Measures "the extent to which rightly acquired property is protected and individuals engage in voluntary transactions"** |
| Voice & accountability | Starting a business | Business #1 | Size of Government #1 |
| Political stability | Dealing with construction permits | Trade #2 | Private Property & the Rule of Law #2 |
| Government effectiveness | Registering a property | Fiscal #3 | Soundness of Money #3 |
| Regulatory quality | Getting credit | Government Spending #4 | Trade Regulation & Tariffs #4 |
| Rule of law | Protecting investors | Monetary #5 | Regulation subcomponents 2008: |
| Control of corruption | Paying taxes | Investment #6 | Labour Market Regulation #5 |
| | Trading across borders | Property Rights #7 | Business Regulation #6, of which |
| | Enforcing contracts | Corruption #8 | *Extra payments/bribes* |
| | Closing a business | Labour #9 | *Licensing restrictions* |
| | | | *Tax compliance* |
| **Sources of data and methodology (descriptions as provided by the data publishers)** | | | |
| The indicators rely exclusively on perceptions-based data sources, which are surveys of households & firms, subjective assessments of experts from a variety of commercial business information providers, NGOs, public sector bodies, and country analysts in multilateral organizations. | "Expert assessment" The survey uses a simple business case to ensure comparability across economies and over time—with assumptions about the legal form of the business, its size, its location and the nature of its operations. Surveys are administered through more than 8,200 local experts, including lawyers, business consultants, accountants, freight forwarders, government officials and other professionals routinely administering or advising on legal and regulatory requirements. | #1 WB Doing Business data plus other expert publications<br>#2 Index based on trade-weighted average tariff rate and non-tariff barriers<br>#3 Index based on top tax rate on individual income, corporate income, and tax revenue as % GDP<br>#4 Government expenditure including transfers as % GDP<br>#5 Index based on recent inflation and existence of price controls<br>#6 Index based on treatment of foreign investment, expropriation, forex and capital controls<br>#7, #8 Assessment from expert publications<br>#9 Quantitative indicators including minimum wage, hiring, firing regulations | #1 Index based on government consumption as share of total consumption, transfers & subsidies as % GDP, SOEs, top marginal tax rate<br>#2 Expert judgement on judicial independence, court impartiality, protection of property rights etc. Sources include WB Governance indicators and Doing Business<br>#3 Index based on money growth, inflation<br>#4 Index based on trade tax revenues, tariff rates, non-tariff barriers, Doing Business time cost to export and import, etc.<br>#5 Index based on hiring & firing, and hours regulations, cost of dismissal<br>#6 Index based e.g. on WEF question on administrative burdens and Doing Business questions on starting a business. |
| Kaufmann, Kraay and Mastruzzi, 2010 www.govindicators.org | www.doingbusiness.org /methodology/methodology-note | www.heritage.org/index/ pdf/2011_Methodology.pdf | www.freetheworld.com /2011/reports/world/ EFW2011_appendix.pdf |

**TABLE A2: Enterprise survey data – country coverage by year**

The table below lists the number of firms in the sample by group (TE or NTE), country and year. All data was obtained from the World Bank's Enterprise Surveys website, http://www.enterprisesurveys.org.

| Country | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **TEs** | | | | | | | | | | |
| Albania | 60 | | | 71 | | 110 | | | | **241** |
| Armenia | 54 | | | 217 | | | | 112 | | **383** |
| Azerbaijan | 35 | | | 185 | | | | 111 | | **331** |
| Belarus | 32 | | | 52 | | | 74 | | | **158** |
| Bosnia and Herzegovin | 56 | | | 64 | | | | 118 | | **238** |
| Bulgaria | 44 | | 324 | 53 | | 538 | | 95 | | **1,054** |
| Croatia | 29 | | | 62 | | 338 | | | | **429** |
| Czech Republic | 63 | | | 78 | | | | 84 | | **225** |
| Estonia | 29 | | | 39 | | | | 90 | | **158** |
| Georgia | 30 | | | 47 | | | 117 | | | **194** |
| Hungary | 51 | | | 352 | | | | 103 | | **506** |
| Kazakhstan | 41 | | | 334 | | | | 179 | | **554** |
| Kyrgyz Republic | 42 | 102 | | 53 | | | | 91 | | **288** |
| Latvia | 28 | | | 33 | | | | 89 | | **150** |
| Lithuania | 35 | | 157 | 41 | | | | 97 | | **330** |
| Macedonia, FYR | 41 | | | 55 | | | | 114 | | **210** |
| Moldova | 42 | 103 | | 198 | | | | 107 | | **450** |
| Montenegro | | 42 | | | | | | 37 | | **79** |
| Poland | 97 | 105 | | 514 | | | | 149 | | **865** |
| Romania | 70 | | | 373 | | | | 184 | | **627** |
| Russian Federation | 111 | | | 137 | | | | 585 | | **833** |
| Serbia | | 101 | | | | | | 129 | | **230** |
| Serbia and Montenegro | 58 | | | 63 | | | | | | **121** |
| Slovak Republic | 25 | | | 32 | | | | 81 | | **138** |
| Slovenia | 45 | | | 55 | | | | 101 | | **201** |
| Tajikistan | 34 | 96 | | 50 | | | 113 | | | **293** |
| Ukraine | 121 | | | 164 | | | 463 | | | **748** |
| Uzbekistan | 44 | 100 | | 63 | | | 114 | | | **321** |
| **Total TEs** | **1,317** | **649** | **481** | **3,385** | | **986** | **881** | **2656** | | **10,355** |
| **NTEs** | | | | | | | | | | |
| Afghanistan | | | | | | | 121 | | | **121** |
| Algeria | 367 | | | | | | | | | **367** |
| Angola | | | | | 214 | | | | | **214** |
| Argentina | | | | | 1,387 | | | | | **1,387** |
| Bangladesh | 970 | | | | | 1,196 | | | | **2,166** |
| Benin | | | 144 | | | | | | | **144** |
| Bolivia | | | | | 770 | | | | | **770** |
| Botswana | | | | | 113 | | | | | **113** |
| Brazil | | 1,619 | | | | | | 902 | | **2,521** |
| Burkina Faso | | | | | 51 | | | 93 | | **144** |
| Burundi | | | | | 101 | | | | | **101** |
| Cambodia | | 62 | | | | | | | | **62** |
| Cameroon | | | | | 119 | | | 116 | | **235** |

| Country | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Cape Verde | | | | | 47 | | | | | **47** |
| Chile | | | 677 | | 1,331 | | | | | **2,008** |
| China | 771 | 907 | | | | | | | | **1,678** |
| Colombia | | | | | 1,283 | | | | | **1,283** |
| Congo, Dem. Rep. | | | | | 149 | | | | | **149** |
| Costa Rica | | | | 338 | | | | | | **338** |
| Cote d'Ivoire | | | | | | | | 169 | | **169** |
| Dominican Republic | | | | 110 | | | | | | **110** |
| Ecuador | | 431 | | | 752 | | | | | **1,183** |
| Egypt, Arab Rep. | | | 956 | | | | | | | **956** |
| El Salvador | | 464 | | | 904 | | | | | **1,368** |
| Eritrea | 57 | | | | | | | | | **57** |
| Ethiopia | 303 | | | | | | | | | **303** |
| Fiji | | | | | | | | 48 | | **48** |
| Gambia, The | | | | | 32 | | | | | **32** |
| Germany | | | | 214 | | | | | | **214** |
| Ghana | | | | | | 290 | | | | **290** |
| Greece | | | | 98 | | | | | | **98** |
| Guatemala | | 435 | | | 641 | | | | | **1,076** |
| Guinea | | | | | 134 | | | | | **134** |
| Guinea-Bissau | | | | | 49 | | | | | **49** |
| Guyana | | | 152 | | | | | | | **152** |
| Honduras | | 446 | | | 523 | | | | | **969** |
| India | 1,716 | | | | 2,043 | | | | | **3,759** |
| Indonesia | | 680 | | | | | | 1,165 | | **1,845** |
| Ireland | | | | 175 | | | | | | **175** |
| Jamaica | | | | 67 | | | | | | **67** |
| Jordan | | | | | 350 | | | | | **350** |
| Kenya | | 226 | | | | 392 | | | | **618** |
| Korea, Rep. | | | | 215 | | | | | | **215** |
| Lao PDR | | | | | 5 | | | | | **5** |
| Lebanon | | | | | 161 | | | | | **161** |
| Lesotho | | 55 | | | | | | | | **55** |
| Madagascar | | | | 277 | | | | 203 | | **480** |
| Malawi | | | | 151 | | | | | | **151** |
| Malaysia | 140 | | | | | | | | | **140** |
| Mali | | 70 | | | | 300 | | | | **370** |
| Mauritania | | | | | 80 | | | | | **80** |
| Mauritius | | | | 164 | | | | 143 | | **307** |
| Mexico | | | | | 2,277 | | | | | **2,277** |
| Mongolia | | | 185 | | | | | 131 | | **316** |
| Morocco | | | 828 | | | | | | | **828** |
| Mozambique | | | | | | 341 | | | | **341** |
| Namibia | | | | | 104 | | | | | **104** |
| Nepal | | | | | | | | 137 | | **137** |
| Nicaragua | | 440 | | | 707 | | | | | **1,147** |
| Niger | | | | 122 | | | | | | **122** |
| Nigeria | | | | | | 947 | | | | **947** |
| Oman | | 97 | | | | | | | | **97** |
| Pakistan | 895 | | | | | | | | | **895** |

| Country | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Panama | | | | | 552 | | | | | **552** |
| Paraguay | | | | | 808 | | | | | **808** |
| Peru | 119 | | | | 721 | | | | | **840** |
| Philippines | | 616 | | | | | | 951 | | **1,567** |
| Portugal | | | | 131 | | | | | | **131** |
| Rwanda | | | | | 57 | | | | | **57** |
| Senegal | | 140 | | | | 259 | | | | **399** |
| South Africa | | 571 | | | | 679 | | | | **1,250** |
| Spain | | | | 134 | | | | | | **134** |
| Sri Lanka | | | 367 | | | | | | | **367** |
| Swaziland | | | | | 70 | | | | | **70** |
| Syrian Arab Republic | | 537 | | | | | | | | **537** |
| Tanzania | | 165 | | | 267 | | | | | **432** |
| Thailand | | | 1,381 | | | | | | | **1,381** |
| Turkey | 133 | | 155 | 1,271 | | | 847 | | | **2,406** |
| Uganda | | 134 | | | 306 | | | | | **440** |
| Uruguay | | | | | 756 | | | | | **756** |
| Vietnam | | | | 1,137 | | | | 748 | | **1,885** |
| Yemen, Rep. | | | | | | | | | 239 | **239** |
| Zambia | 83 | | | | | 298 | | | | **381** |
| **Total NTEs** | **5,554** | **8,095** | **4,845** | **4,604** | **17,864** | **4,702** | **968** | **4,806** | **239** | **51,677** |
| **GRAND TOTAL** | **6,871** | **8,744** | **5,326** | **7,989** | **17,864** | **5,688** | **1,849** | **7,462** | **239** | **62,032** |

**TABLE A3: Partialling-out regressions**

The table below reports the basic results for the first-step fixed effects estimates of equation (26). Fixed effects correspond to country surveys. Each public input is estimated separately for NTEs, TEs for the period 2002-05 (BEEPS II & III), and TEs for the period 2007-09 (BEEPS IV). Standard errors are in parentheses; they are reported for information only and are not used for the tests in the paper. Bold and italic indicates significant at the 5% level. The constant column reports the estimated mean fixed effect.

| Constraint | Country group | log(L) | foreign | exporter | importer | constant | N (obs) | N (svys) |
|---|---|---|---|---|---|---|---|---|
| Access Land | NTE | ***-0.0440*** | ***-0.0766*** | 0.0114 | ***0.0954*** | ***0.8310*** | 49,018 | 111 |
| | | (0.0045) | (0.0182) | (0.0135) | (0.0147) | (0.0070) | | |
| | TE 2002-05 | ***-0.0414*** | ***0.0992*** | -0.0292 | -0.0091 | ***0.6688*** | 5,386 | 61 |
| | | (0.0099) | (0.0399) | (0.0341) | (0.0344) | (0.0196) | | |
| | TE 2007-09 | ***-0.0354*** | -0.0991 | -0.0857 | ***0.1461*** | ***1.1486*** | 4,149 | 28 |
| | | (0.0174) | (0.0670) | (0.0520) | (0.0505) | (0.0296) | | |
| Bus Licensing | NTE | 0.0047 | ***-0.0347*** | 0.0077 | ***0.2527*** | ***0.8707*** | 49,170 | 110 |
| | | (0.0044) | (0.0176) | (0.0131) | (0.0144) | (0.0068) | | |
| | TE 2002-05 | -0.0027 | ***0.0866*** | 0.0175 | 0.0608 | ***1.0140*** | 5,577 | 61 |
| | | (0.0106) | (0.0425) | (0.0363) | (0.0368) | (0.0209) | | |
| | TE 2007-09 | 0.0206 | 0.0416 | 0.0107 | 0.0455 | ***1.1187*** | 4,226 | 28 |
| | | (0.0152) | (0.0589) | (0.0459) | (0.0447) | (0.0259) | | |
| Corruption | NTE | ***-0.0261*** | ***-0.0729*** | 0.0029 | ***0.4607*** | ***1.4917*** | 49,490 | 111 |
| | | (0.0055) | (0.0220) | (0.0163) | (0.0178) | (0.0085) | | |
| | TE 2002-05 | -0.0060 | -0.0165 | -0.0347 | 0.0638 | ***1.2853*** | 5,108 | 60 |
| | | (0.0117) | (0.0470) | (0.0406) | (0.0402) | (0.0233) | | |
| | TE 2007-09 | -0.0229 | -0.0693 | 0.0089 | 0.0532 | ***1.7155*** | 4,246 | 28 |
| | | (0.0172) | (0.0674) | (0.0519) | (0.0507) | (0.0295) | | |
| Courts | NTE | ***0.0366*** | -0.0296 | 0.0097 | ***0.3036*** | ***0.7924*** | 39,360 | 95 |
| | | (0.0049) | (0.0195) | (0.0145) | (0.0151) | (0.0077) | | |
| | TE 2002-05 | ***0.0427*** | 0.0073 | ***-0.0928*** | 0.0695 | ***1.1892*** | 5,352 | 61 |
| | | (0.0110) | (0.0442) | (0.0376) | (0.0382) | (0.0217) | | |
| | TE 2007-09 | 0.0169 | 0.0270 | 0.0032 | 0.0865 | ***1.2939*** | 4,096 | 28 |
| | | (0.0164) | (0.0641) | (0.0493) | (0.0482) | (0.0284) | | |
| Crime Theft Disorder | NTE | -0.0032 | ***-0.0394*** | ***-0.0568*** | ***0.2593*** | ***1.1212*** | 48,019 | 108 |
| | | (0.0048) | (0.0190) | (0.0142) | (0.0156) | (0.0074) | | |
| | TE 2002-05 | ***-0.0283*** | -0.0132 | -0.0423 | 0.0203 | ***0.9505*** | 5,521 | 61 |
| | | (0.0102) | (0.0412) | (0.0351) | (0.0358) | (0.0202) | | |
| | TE 2007-09 | -0.0118 | -0.1070 | -0.0625 | -0.0431 | ***1.3317*** | 4,407 | 28 |
| | | (0.0159) | (0.0620) | (0.0481) | (0.0469) | (0.0271) | | |
| Customs | NTE | ***0.0516*** | ***0.0887*** | ***0.2031*** | ***0.6873*** | ***0.7107*** | 46,453 | 110 |
| | | (0.0045) | (0.0176) | (0.0132) | (0.0143) | (0.0071) | | |
| | TE 2002-05 | ***0.0386*** | ***0.1272*** | ***0.2779*** | ***0.3171*** | ***0.9504*** | 5,306 | 61 |
| | | (0.0109) | (0.0430) | (0.0368) | (0.0373) | (0.0219) | | |
| | TE 2007-09 | 0.0137 | 0.0969 | ***0.1932*** | ***0.3608*** | ***0.7666*** | 3,923 | 28 |
| | | (0.0157) | (0.0596) | (0.0459) | (0.0447) | (0.0280) | | |
| Electricity | NTE | ***-0.0114*** | -0.0188 | 0.0187 | ***0.3166*** | ***1.4811*** | 50,166 | 111 |
| | | (0.0052) | (0.0209) | (0.0155) | (0.0169) | (0.0080) | | |
| | TE 2002-05 | -0.0074 | -0.0064 | -0.0129 | -0.0502 | ***0.6683*** | 5,798 | 61 |
| | | (0.0090) | (0.0363) | (0.0309) | (0.0314) | (0.0177) | | |
| | TE 2007-09 | 0.0140 | -0.1087 | -0.0614 | 0.0793 | ***1.7045*** | 4,489 | 28 |

| Constraint | Country group | log(L) | foreign | exporter | importer | constant | N (obs) | N (svys) |
|---|---|---|---|---|---|---|---|---|
| | | (0.0187) | (0.0731) | (0.0567) | (0.0554) | (0.0318) | | |
| Gov Policy Unc | NTE | ***0.0470*** | -0.0090 | -0.0144 | ***0.0760*** | ***1.5636*** | 25,936 | 62 |
| | | (0.0065) | (0.0271) | (0.0192) | (0.0233) | (0.0103) | | |
| | TE 2002-05 | ***0.0211*** | -0.0590 | -0.0038 | 0.0449 | ***1.7747*** | 5,667 | 61 |
| | | (0.0104) | (0.0417) | (0.0354) | (0.0362) | (0.0204) | | |
| Inad Educ Labor | NTE | ***0.0374*** | ***-0.1078*** | 0.0072 | ***0.3686*** | ***1.1018*** | 49,986 | 111 |
| | | (0.0046) | (0.0186) | (0.0137) | (0.0150) | (0.0071) | | |
| | TE 2002-05 | ***0.0230*** | 0.0441 | ***0.1156*** | ***0.0840*** | ***1.0131*** | 5,706 | 61 |
| | | (0.0103) | (0.0415) | (0.0353) | (0.0360) | (0.0203) | | |
| | TE 2007-09 | ***0.0598*** | -0.0514 | ***0.1491*** | ***0.0945*** | ***1.7181*** | 4,438 | 28 |
| | | (0.0157) | (0.0613) | (0.0476) | (0.0465) | (0.0268) | | |
| Labor Reg | NTE | ***0.0532*** | ***-0.0648*** | ***0.0540*** | ***0.2673*** | ***0.9213*** | 49,603 | 110 |
| | | (0.0043) | (0.0174) | (0.0129) | (0.0141) | (0.0067) | | |
| | TE 2002-05 | ***0.0445*** | 0.0087 | ***0.0934*** | 0.0234 | ***0.9396*** | 5,653 | 61 |
| | | (0.0096) | (0.0387) | (0.0329) | (0.0335) | (0.0190) | | |
| | TE 2007-09 | ***0.0475*** | -0.0285 | ***0.1197*** | ***0.0940*** | ***0.9678*** | 4,475 | 28 |
| | | (0.0134) | (0.0524) | (0.0406) | (0.0398) | (0.0228) | | |
| Macro Instability | NTE | ***0.0388*** | ***-0.0565*** | ***0.1077*** | ***0.0612*** | ***1.8746*** | 31,781 | 85 |
| | | (0.0063) | (0.0248) | (0.0182) | (0.0199) | (0.0100) | | |
| | TE 2002-05 | ***0.0268*** | -0.0144 | ***0.0782*** | 0.0355 | ***1.7325*** | 5,674 | 61 |
| | | (0.0104) | (0.0418) | (0.0356) | (0.0363) | (0.0205) | | |
| Political Instability | NTE | 0.0108 | -0.0413 | ***0.0861*** | ***0.0591*** | ***1.6045*** | 18,473 | 51 |
| | | (0.0078) | (0.0303) | (0.0237) | (0.0227) | (0.0121) | | |
| | TE 2007-09 | 0.0197 | -0.0754 | 0.0698 | -0.0866 | ***1.8372*** | 4,328 | 28 |
| | | (0.0169) | (0.0663) | (0.0511) | (0.0499) | (0.0290) | | |
| Tax Administration | NTE | 0.0009 | ***-0.0613*** | 0.0040 | ***0.3462*** | ***1.3101*** | 49,611 | 110 |
| | | (0.0048) | (0.0193) | (0.0143) | (0.0157) | (0.0074) | | |
| | TE 2002-05 | -0.0123 | 0.0200 | 0.0291 | ***0.0793*** | ***1.5784*** | 5,690 | 61 |
| | | (0.0106) | (0.0426) | (0.0363) | (0.0370) | (0.0208) | | |
| | TE 2007-09 | 0.0096 | -0.0013 | ***0.1112*** | 0.0409 | ***1.4997*** | 4,464 | 28 |
| | | (0.0151) | (0.0590) | (0.0459) | (0.0448) | (0.0258) | | |
| Telecoms | NTE | ***0.0273*** | ***0.0952*** | ***0.0519*** | 0.0239 | ***0.6822*** | 30,617 | 85 |
| | | (0.0052) | (0.0205) | (0.0155) | (0.0173) | (0.0081) | | |
| | TE 2002-05 | -0.0133 | 0.0097 | 0.0157 | -0.0057 | ***0.4668*** | 5,728 | 61 |
| | | (0.0079) | (0.0318) | (0.0272) | (0.0276) | (0.0156) | | |
| Transport | NTE | ***0.0243*** | 0.0242 | 0.0111 | ***0.2951*** | ***0.8803*** | 49,680 | 110 |
| | | (0.0044) | (0.0177) | (0.0131) | (0.0143) | (0.0068) | | |
| | TE 2002-05 | 0.0079 | ***0.0722*** | 0.0015 | 0.0119 | ***0.5706*** | 5,772 | 61 |
| | | (0.0087) | (0.0350) | (0.0299) | (0.0303) | (0.0171) | | |
| | TE 2007-09 | ***0.0368*** | 0.0644 | -0.0313 | 0.0749 | ***1.1078*** | 4,448 | 28 |
| | | (0.0161) | (0.0628) | (0.0487) | (0.0476) | (0.0274) | | |

**TABLE A4: Second-step estimations**

The table below reports the results for the second-step estimates of equation (27). Each public input is estimated twice, first pooling NTEs with TEs for the period 2002-05 (BEEPS II & III), and second pooling the same sample of NTEs with TEs for the period 2007-09 (BEEPS IV). Heteroskedastic-robust standard errors are in parentheses. Cross-equation tests are based on pooling these separate estimations using the Stata command *suest*, clustering on firm, and are not reported here. Bold and italic indicates significant at the 5% level. GDP per capita $\overline{A}_j$ is centred at the ln($7,500), the middle of the TE range for the period and sample of countries we have. The constant column can be interpreted as the estimated mean reported cost of input *p* for an NTE with this level of income, and the coefficient on the dummy variable $TE_j$ is an estimate of the difference between reported costs in a TE compared to an NTE, holding income constant at this level.

| Constraint | Comparison | Low income intercept δ0 | Low income TE δ2 | High income intercept δ0 | High income TE δ2 | log(GDP) δ1 | log(GDP)*TE δ3 | N obs | N countries |
|---|---|---|---|---|---|---|---|---|---|
| Access Land | NTE vs. TE 2002-05 | ***0.8795*** | ***-0.1775*** | ***0.4119*** | ***0.2173*** | ***-0.3016*** | ***0.2546*** | 54,404 | 110 |
| | | (0.0059) | (0.0193) | (0.0097) | (0.0225) | (0.0765) | (0.0989) | | |
| | NTE vs. TE 2007-09 | | ***0.3735*** | | ***0.6808*** | | 0.1982 | 53,167 | 109 |
| | | | (0.0437) | | (0.0308) | | (0.1980) | | |
| Bus Licensing | NTE vs. TE 2002-05 | ***0.8792*** | ***0.2039*** | ***0.7969*** | ***0.1367*** | -0.0531 | -0.0433 | 54,747 | 110 |
| | | (0.0056) | (0.0207) | (0.0103) | (0.0237) | (0.0796) | (0.1120) | | |
| | NTE vs. TE 2007-09 | | ***0.2634*** | | ***0.3089*** | | 0.0293 | 53,396 | 109 |
| | | | (0.0364) | | (0.0271) | | (0.1282) | | |
| Corruption | NTE vs. TE 2002-05 | ***1.5238*** | ***-0.1354*** | ***1.2056*** | -0.0401 | -0.2052 | 0.0615 | 54,598 | 110 |
| | | (0.0071) | (0.0245) | (0.0128) | (0.0274) | (0.1081) | (0.1539) | | |
| | NTE vs. TE 2007-09 | | ***0.4183*** | | ***0.3881*** | | -0.0195 | 53,736 | 109 |
| | | | (0.0465) | | (0.0322) | | (0.2104) | | |
| Courts | NTE vs. TE 2002-05 | ***0.7972*** | ***0.3458*** | ***0.7708*** | ***0.4692*** | -0.0170 | 0.0796 | 44,712 | 100 |
| | | (0.0066) | (0.0224) | (0.0107) | (0.0257) | (0.0909) | (0.1545) | | |
| | NTE vs. TE 2007-09 | | ***0.5380*** | | ***0.5019*** | | -0.0233 | 43,456 | 99 |
| | | | (0.0434) | | (0.0290) | | (0.1446) | | |
| Crime, Theft, Disorder | NTE vs. TE 2002-05 | ***1.1370*** | ***-0.1916*** | ***0.9746*** | -0.0184 | -0.1048 | 0.1117 | 53,540 | 107 |
| | | (0.0063) | (0.0211) | (0.0112) | (0.0247) | (0.0874) | (0.1488) | | |
| | NTE vs. TE 2007-09 | | ***0.5125*** | | ***0.1852*** | | -0.2111 | 52,426 | 106 |
| | | | (0.0436) | | (0.0279) | | (0.1602) | | |
| Customs | NTE vs. TE 2002-05 | ***0.7385*** | ***0.3450*** | ***0.4481*** | ***0.3505*** | ***-0.1873*** | 0.0035 | 51,759 | 110 |
| | | (0.0057) | (0.0221) | (0.0099) | (0.0243) | (0.0687) | (0.1072) | | |
| | NTE vs. TE 2007-09 | | ***0.2913*** | | ***0.1811*** | | -0.0711 | 50,376 | 109 |
| | | | (0.0414) | | (0.0274) | | (0.1209) | | |
| Electricity | NTE vs. TE 2002-05 | ***1.5672*** | ***-0.7983*** | ***0.7076*** | ***-0.1575*** | ***-0.5544*** | ***0.4133*** | 55,964 | 110 |
| | | (0.0066) | (0.0195) | (0.0117) | (0.0217) | (0.0747) | (0.1123) | | |
| | NTE vs. TE 2007-09 | | ***0.4138*** | | ***0.8465*** | | 0.2791 | 54,655 | 109 |
| | | | (0.0452) | | (0.0343) | | (0.1614) | | |
| Gov Policy Unc | NTE vs. TE 2002-05 | ***1.5740*** | ***0.1815*** | ***1.4549*** | ***0.3417*** | -0.0768 | 0.1033 | 31,603 | 79 |
| | | (0.0093) | (0.0223) | (0.0174) | (0.0284) | (0.1559) | (0.1933) | | |
| | NTE vs. TE 2007-09 | | n.a. | | n.a. | | n.a. | n.a. | n.a. |
| | | | n.a. | | n.a. | | n.a. | | |
| Inad Educ Labor | NTE vs. TE 2002-05 | ***1.0998*** | ***-0.2058*** | ***1.1195*** | 0.0296 | 0.0128 | 0.1518 | 55,692 | 110 |
| | | (0.0057) | (0.0194) | (0.0108) | (0.0240) | (0.0823) | (0.1041) | | |
| | NTE vs. TE 2007-09 | | ***0.7053*** | | ***0.5513*** | | -0.0993 | 54,424 | 109 |
| | | | (0.0400) | | (0.0292) | | (0.1588) | | |
| Labor Reg | NTE vs. TE 2002-05 | ***0.9038*** | ***-0.1643*** | ***1.0708*** | ***0.0934*** | 0.1077 | 0.1661 | 55,256 | 110 |
| | | (0.0055) | (0.0175) | (0.0106) | (0.0235) | (0.0942) | (0.1272) | | |
| | NTE vs. TE 2007-09 | | ***-0.1549*** | | 0.0158 | | 0.1101 | 54,078 | 109 |
| | | | (0.0311) | | (0.0250) | | (0.1210) | | |
| Macro Instability | NTE vs. TE 2002-05 | ***1.8557*** | ***-0.0922*** | ***2.0525*** | ***-0.3557*** | 0.1269 | -0.1699 | 37,455 | 100 |
| | | (0.0082) | (0.0219) | (0.0150) | (0.0266) | (0.1142) | (0.1546) | | |
| | NTE vs. TE 2007-09 | | n.a. | | n.a. | | n.a. | n.a. | n.a. |
| | | | n.a. | | n.a. | | n.a. | | |
| Political Instability | NTE vs. TE 2002-05 | ***1.5962*** | n.a. | ***1.8472*** | n.a. | 0.1619 | n.a. | n.a. | n.a. |
| | | (0.0109) | n.a. | (0.0203) | n.a. | (0.1677) | n.a. | | |
| | NTE vs. TE 2007-09 | | ***0.4493*** | | ***-0.1197*** | | -0.3669 | 22,801 | 78 |
| | | | (0.0472) | | (0.0356) | | (0.2619) | | |
| Tax Administration | NTE vs. TE 2002-05 | ***1.3396*** | ***0.3002*** | ***1.0443*** | ***0.4632*** | -0.1904 | 0.1051 | 55,301 | 110 |
| | | (0.0064) | (0.0210) | (0.0116) | (0.0256) | (0.1106) | (0.1513) | | |
| | NTE vs. TE 2007-09 | | ***0.1013*** | | ***0.4873*** | | 0.2489 | 54,075 | 109 |
| | | | (0.0377) | | (0.0281) | | (0.1467) | | |
| Telecoms | NTE vs. TE 2002-05 | ***0.6716*** | ***-0.1799*** | ***0.4183*** | 0.0198 | ***-0.1634*** | 0.1288 | 36,345 | 99 |
| | | (0.0062) | (0.0163) | (0.0124) | (0.0201) | (0.0473) | (0.0667) | | |
| | NTE vs. TE 2007-09 | | n.a. | | n.a. | | n.a. | n.a. | n.a. |
| | | | n.a. | | n.a. | | n.a. | | |
| Transport | NTE vs. TE 2002-05 | ***0.9176*** | ***-0.3515*** | ***0.5378*** | 0.0382 | ***-0.2450*** | ***0.2514*** | 55,452 | 109 |
| | | (0.0055) | (0.0168) | (0.0097) | (0.0202) | (0.0505) | (0.0703) | | |
| | NTE vs. TE 2007-09 | | ***0.2394*** | | ***0.5432*** | | 0.1959 | 54,128 | 108 |
| | | | (0.0392) | | (0.0282) | | (0.1123) | | |

Notes:
Coefficients are obtained from estimation of equation (30) in main text.
Intercepts and SEs for "NTE vs. TE 2007-09" are identical to "NTE vs. TE 2002-05" and hence are not shown.
SEs for intercepts and TE dummies are robust to heteroskedasticity.
SEs for GDP terms are robust to heteroskedasticity and clustering on country.