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EMPIRICAL EVIDENCE FROM CHINA**

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Nancy H Chau, Cornell University
Ravi Kanbur, Cornell University and CEPR
Yu Qin, Cornell University

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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

Do Public Work Schemes Deter or Encourage Outmigration? Empirical Evidence from China

How does the introduction of rural public work schemes impact individual incentives to migrate? This paper examines this question in the context of rural public work program (Yigong-daizhen) in China, and unveils empirical evidence that suggest that the introduction of Yigong-daizhen projects in fact stimulates outmigration at the village level, after controlling for village characteristics and project types. By furthermore accounting for the endogeneity of Yigong-daizhen placement, the impact of such projects is found to be even larger. These results are consistent with household migration behavior in the presence of significant cost of migration, and credit market imperfection.

JEL Classification: H53, J43 and O15

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Nancy H Chau
Charles H Dyson School of Applied
Economics & Management
Cornell University
Warren Hall
Ithaca NY 14853-7801
USA

Ravi Kanbur
Charles H Dyson School of Applied
Economics & Management
and Department of Economics
Cornell University
Warren Hall
Ithaca NY 14853-7801
USA

Email: hyc3@cornell.edu

Email: sk145@cornell.edu

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Yu Qin
Charles H Dyson School of Applied
Economics & Management
Cornell University
Warren Hall
Ithaca NY 14853-7801
USA

Email: yq38@cornell.edu

For further Discussion Papers by this author see:
www.cepr.org/pubs/new-dps/dplist.asp?authorid=174873

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I. Introduction

A distinctive feature of the Chinese economic growth experience has been the massive increase in rural migrant work force living in China's cities since the onset of economic reforms in the 1980's. By 2007, the estimated number of rural migrants exceeded over 135 million (Meng et al., 2010). The mobilization of this sizeable workforce has wide-ranging consequences, including contributions to the growth of export industries (Chan, 2008), shifts in income distribution between urban and rural China (Ha et al., 2009), and changes in educational and health outcomes over time between migrants and non-migrants (Lee, 2011), for example. The depth and breadth of these research studies concerning the consequences of rural-urban migration in China contrast sharply with the relatively limited number of studies on the effectiveness of migration policies in China. Indeed, much of the policy discourse on China's internal migration policy has focused on the *hukou* system of household registration (Chan, 2008). As a first objective of this paper, we examine the role of rural public work schemes as an alternative migration regulatory mechanism in the Chinese context.

To the best of our knowledge, this is a first attempt at an empirical assessment of the role of *Yigong-daizhen* programs on the pattern of migration in China. As a contribution to policy analysis, in view of the massive influx of rural migrants into China's urban cities, whether these rural public work schemes serve as deterrents that mitigate the size of the migrant flow, or in fact further intensify out migration is a question of critical policy importance. As a contribution to the economics of migration, this paper brings together three strands of the literature not often discussed together: labor market consequence of public work schemes, determinants of regional migration, and behavior in the presence of credit market

imperfection.

By a public work scheme, we refer to the public provision of employment opportunities resulting in the creation of public goods, such as roads and schools. These employment opportunities serve as a form of social safety net, at a prescribed wage for those unable to find alternative employment. Worldwide, the implementation of public work schemes spans transition countries, developing countries and developed countries (Betcherman et al., 2004). A number such public work schemes, such as the Maharashtra Employment Guarantee Scheme (EGS), and more recently the Mahatma Gandhi Employment Guarantee Schemes in India, have attracted much academic and policy attention, (Acharya, 1990; Ravallion et al., 1993; Gaiha, 1996a, b, 2000; Basu et al., 2009). Research on the labor market consequences of these more well-known public work schemes has so far focused on employment, earnings, and targeting.^{1,2,3}

By contrast, the labor market consequence of public work schemes in China is a far less well-understood topic. Specifically, *Yigong-daizhen* -- to offer job opportunities instead of sheer relief -- is a public work scheme initiated in the mid-1980s a part of the Chinese government's poverty reduction programs (Rozelle et al., 1998). Research on the effectiveness of these programs has been very limited. Two exceptions are Park et al. (2002) and Zhu and Jiang (1995), emphasizing respectively the targeting effectiveness, and the earnings impact of *Yigong-daizhen* programs.^{4,5} While offering valuable insights, neither of these studies identify program-specific effects due mainly to data limitation. In addition, identification also requires proper accounting of endogeneity of program selection among participating villages or county -- these are issues that we will pay particular attention to in

our analysis in the sequel.

This paper is also related to a rapidly growing literature on the determinants of inter-regional migration in China. Some of these determinants include the potential role of farmland shortages and availability of household labor (Zhao, 1999a), earning differences between destinations and origins (Zhao, 1999b; Zhu, 2002; Zhang and Song, 2003), as well as the cost of migration (Zhang and Song, 2003) whether monetary or psychic (Sjaastad, 1962). At the household level, participating in migration has been shown to significantly raise per capita income as high as 16 to 43 percent (Taylor et al., 2003). Open questions abound. In particular, what roles do policies play in regulating the direction and size of the flow of internal migrants in China? Indeed, how do the direct provision of employment opportunities and the provision of public goods in rural villages impact the outflow of migrants from rural areas?⁶

Finally, this paper is also related to the literature on behavior in the presence of credit market imperfection. In a wide variety of settings, credit market imperfections have been shown to fundamentally alter the properties of equilibrium, giving rise for example to non-monotonic, and / or distributionally sensitive comparative statics responses (Galor and Zeira, 1993; Matsuyama, 2008). In the context of migration, credit market imperfection is expected to play a critical role particularly when the upfront cost of migration is significant. Indeed, several studies (Du et al., 2005; McKenzie and Rapoport, 2007) document an inverted-U shape relationship between household endowments and migration likelihood. That is, households with middle wealth are more willing to and able to migrate.

Following the lessons that can be drawn from these three strands of literature, we argue that

Yigong-daizhen programs introduce two opposing forces on the village level propensity for outmigration. By increasing available employment opportunities and raising earnings and production efficiency through public goods provision in general, *Yigong-daizhen* programs narrows the expected earnings gap between destination and sending locations, thus potentially discouraging outmigration. Going in the opposite direction, by raising individual / household's ability to pay for the cost of migration, due either to the improvements in earnings thanks to *Yigong-daizhen* programs in the face of credit market imperfection that has previously deterred attempts to migrate, or to public construction that directly decreases the cost of migration by improving transportation and building roads, public work schemes can in fact stimulate outmigration. On balance, the net outcome of *Yigong-daizhen* programs on village level outmigration will in the end depend on the relative strength of these two effects.⁷

In this paper, we take this issue to the data using the Center for Chinese Agricultural Policy (CCAP) 2003 Village Survey, covering 2,459 villages in six provinces in China (Jiangsu, Sichuan, Shaanxi, Gansu, Hebei and Jilin in the year of 2003). We are interested in assessing the outmigration impact of introducing *Yigong-daizhen* programs at the village level. In order to identify program-specific effects, we employ a difference in difference approach. To furthermore account for the issue of endogenous program selection, we employ a 2SLS approach with instrumental variables. In a series of regressions, the preponderance of the evidence suggests that *Yigong-daizhen* programs have in fact facilitated the outmigration of workers. Consistent with Du et al. (2005) and McKenzie and Rapoport (2007) and the implications of models with significant cost of migration and imperfect credit markets, we also find an inverted U-shape relationship between average per capita income and

outmigration at the village level. Finally, to address the potential heterogeneity of *Yigong-daizhen* programs across villages, we work with four restricted samples: (A) villages with productivity improving public projects, such as irrigation system improvement, drainage system improvement, soil improvement, small-scale water conservation and terrace construction projects, (B) villages without productivity improving public projects, (C) villages with migration cost decreasing public investments through roads and bridge construction projects, and (D) villages without roads and bridge construction projects. The impacts of *Yigong-daizhen* programs on outmigration in these specifications continue to be positive and significant, and indeed, the impact of *Yigong-daizhen* in villages with newly constructed roads is positive and larger than the other villages. These findings suggest the potentially critical roles that cost of migration and credit market imperfections play in the determination of the inter-regional flow of migrants in China.

The plan of the rest of this paper is as follows. Section II describes the institutional background of *Yigong-daizhen* program in China. Section III provides the summary of statistics of the data used in this paper. Section IV discusses about the identification strategy. Section V shows the empirical findings and Section VI concludes.

II. Country Background

The *Yigong-daizhen* program in China was initiated in the mid-1980s by the Chinese government as part of the rural poverty-reduction programs. Table 1 shows the types of projects, the amount of investment and the achievements of *Yigong-daizhen* projects from 1985 to 2000. In terms of program goals, there are mainly four general categories, including

rural land construction and irrigation system construction, road construction, drinking water facilities improvements and small-scale water conservation. Forestry and meadow maintenance, river and lake conservation are also included in the *Yigong-daizhen* project schemes from 1985 to 1995.

The amount of investment on each category of *Yigong-daizhen* projects is also presented in Table 1. Rural land construction, irrigation system construction, as well as road construction take up around 60 per cent of the total investment in 1985-1995, and around 80 per cent of the total investment in 1995-2000. Total investment in *Yigong-daizhen* projects is substantial, amounting to 2.62 billion *yuan*, or around US\$ 0.38 billion.

The Chinese central government provided both monetary and in-kind investments. Table 2 shows the types of in-kind investment made by the government, such as cereals, cloth, edible oil, grains and medium- and low-grade consumer goods. In the year 2005, the Regulation of *Yigong-daizhen* Projects was implemented (NDRC, 2005). The legislation laid out the regulations that governed the implementation of *Yigong-daizhen* projects. Before the end of each calendar year, the Development and Reform Commission at the provincial level are to report to the National Development and Reform Commission about project plans for *Yigong-daizhen* in the following year. Furthermore, the National Development and Reform Commission are expected to prepare a national level *Yigong-daizhen* projects plan according to the various economic condition of each province. In terms of payments to contracted laborers, the Regulation of *Yigong-daizhen* projects stipulates that wages should be paid without delay and default. In some provinces, such as Sichuan, information on each *Yigong-daizhen* project, including source of funding, expected outcomes, as well as

implementation year of the projects are published online and made open for public scrutiny.

The main difference between the *Yigong-daizhen* programs in China and other public work schemes, such as the EGS program in India, is the wage rate paid to the employed workers and the potential impact that this has on inter-regional migration. It is documented that the wage paid to the unskilled day laborers in the local villages was around 10 *yuan* (around 1.5 USD) per day during the year 1998 to 2002. This was much lower than the wage of migrant workers (Luo et al., 2007). For example, in the rural area of Sichuan province in 1995, an out-migrant helped to increase an average of 2,388 *yuan* more of household earnings than a non-migrants per year, relative to an average net income per capita of 1354.66 *yuan* and an average household size around 4, or around 10 *yuan* per day assuming that a worker works five days a week (Zhao, 1999a). Thus, a rural-urban wage gap continued to exist, and remained large despite the introduction of *Yigong-daizhen* programs. By contrast, the EGS in Neelamangalam, India, for example, pays the minimum wage at 80 rupees a days, a figure very close to the day wages of unskilled migrants, which could be less than 100 rupees a day. (Naomi, 2008).

III. Data Description

The village level data used in this paper is obtained from Center for Chinese Agricultural Policy (CCAP) 2003 Village Survey. It surveyed 2,459 villages in six provinces in China, namely Jiangsu, Sichuan, Shaanxi, Gansu, Hebei and Jilin in the year of 2003. The survey collected a great deal of information about village affairs. In addition to the basic village characteristics, the survey collected information on village level public goods investment,

governance systems, as well as the general regulatory environment, such as 1) the attitude of upper government toward violation of One Child Policy, 2) whether women married into the village are eligible for land allocation and 3) how long it generally takes to get a license for small business, for example.

In China, the key items of public investment in the rural villages are often related to basic infrastructure improvement, such as road construction, irrigation system improvement, school construction and so on. Table 3 shows the summary statistics for all the village public projects of the 2,459 surveyed villages. Across all 10,967 public projects implemented during 1998-2002, road and bridge construction projects represent up to 14.2 per cent of the overall number of projects. In addition, roads and bridges construction, along with electricity and telephone facilities, and Grain for Green projects constitutes more than half (53.82%) of the overall projects.⁸

Table 3 also reports the average amount of investment, the average labor used in the projects and the number of benefitted households. The average investment of a project for the whole sample is 158,918 *yuan* (about 23,370 USD.) Telephone and electricity facilities are the costliest projects in terms of average investment. The average labor used is 887.33 day laborers per project, and soil improvement projects are the most labor intensive. The average number of benefitting households is 262.95 per project. Across all projects, road and bridge construction projects have the widest coverage benefitting an average of 459.15 households per project.

As a subset of these public investment projects dedicated to alleviating rural poverty in China, *Yigong-daizhen* is a public work scheme initiated in 1984.⁹ The funding of the

Yigong-daizhen projects is allocated to the local governments for local infrastructure construction using local laborers, where the payment to the laborers accounts for around 20 per cent of the total funding, at a wage around 10 *yuan* (around 1.5 USD) per person per day (Luo et al., 2007).

Table 4 displays program related summary statistics exclusively related to *Yigong-daizhen* projects. There are in total 549 *Yigong-daizhen* projects between 1998 and 2002 in our sample. Among the 549 projects, 148 (26.96%) projects are roads and bridges construction. Electricity and drinking water facilities are the second and third popular projects in terms of the type of the *Yigong-daizhen* projects. The average investment of a *Yigong-daizhen* project is 17,249.05 *yuan*, and this represents around 11 per cent of the average investment of all the public investment projects. The average labor used of a *Yigong-daizhen* project is 1,534.51 day laborers per project, which is almost doubled compared to the average labor used of all the public projects. On average a *Yigong-daizhen* project benefits 342.9 households, higher than the average coverage of all the public investment projects.

IV. Econometric Issues and Identification Strategies

Heterogeneity by Income Quartiles

Our empirical estimation tests the impact of *Yigong-daizhen* on village level outmigration. As argued earlier in the introduction, and demonstrated formally in Qin (2011), the impact of *Yigong-daizhen* on outmigration behavior will depend critically on (i) the cost of migration, and (ii) the presence of credit market imperfection. With significant upfront cost of migration and imperfect credit markets, we would expect *Yigong-daizhen* projects to have a positive

impact on the number of outmigrants in the village. By contrast, if there is perfect credit market in the village that no households are bound by credit constraints, then improving employment prospects and earnings via *Yigong-daizhen* projects should have the opposing effect of decreasing the number of out-migrants. Importantly, the relative importance of the cost of migration and of imperfect credit markets is likely dependent on the average income of the village in question. To capture the potential heterogeneity in program impact by average per capita income in a village, we will provide quartile specific estimates of the impact of *Yigong-daizhen* projects on out-migration.

Heterogeneity by Program Characteristics

As discussed earlier in Section I, different public investment projects should be expected to have different implications on the urban-rural wage gap, and the cost of migration in the *Yigong-daizhen* villages. In particular, productivity improving projects such as irrigation system improvement, drainage system improvement, soil improvement, small-scale water conservation and terrace construction projects may be viewed productivity improving, potentially narrowing the urban-rural wage gap. Other programs such as road and bridge construction may be seen more as migration cost reducing. To account for program-specific heterogeneity across *Yigong-daizhen* projects, we will examine four restricted panels. The first includes only villages with five types of ‘productivity improvement’ projects. The second is the complementary set with villages that lack ‘productivity improvement’ projects. The third panel includes only villages with road and bridge construction projects, and as such, are more likely to experience migration cost reduction. The fourth panel includes the complementary set of the third restricted sample, i.e., villages without road and bridge

construction projects during the survey periods.

Endogenous Program Selection

Naturally, whether *Yigong-daizhen* projects are implemented in a village is likely to depend on village characteristics. Based on information available from our sample, *Yigong-daizhen* projects are more likely to be implemented in villages with more surplus laborers and less income per capita if it is correctly targeted. Table 5 shows the differences in village characteristics by *Yigong-daizhen* status. Results from t-tests between the two groups show that villages with *Yigong-daizhen* projects on average have significantly lower net income per capita, larger village size (higher total population), higher proportion of land steeper than 25 degrees, longer distance from the village committee (usually locating near the center of the village) to the nearest tarred road and more fellow villagers working at township. These suggest strongly that the endogeneity of program placement needs to be accounted for in our econometric model.

Unobserved Heterogeneity

Due to data limitation, we do not have information on the implementation of *Yigong-daizhen* projects in the surveyed villages prior to year 1997. Thus, it is likely that labor market equilibrium in the villages was affected not only by the *Yigong-daizhen* projects implemented during year 1998-2002, but also by the ones implemented before 1997. To mitigate the impact of these unobservable differences across villages, we opt to take the difference between the outcome variables in 2002 and 1997 using the balanced panel data. Assuming that the long term impacts of such projects do not vary significantly across years, the resulting estimates should provide an unbiased assessment of the impact of *Yigong-daizhen* projects.

In view of these econometric issues and identification challenges, we will provide first a series of baseline OLS regressions of a difference in difference model with and without provincial fixed effects. The Difference-in-Difference specification is as follows:

$$\Delta\text{Outmig}_i = \alpha + \beta_1 \text{YGDZ}_i + \beta_2 \text{Village}_{i,1997} + \sum \gamma_k \text{Project},k + \sum \phi_k \text{Province},k + \varepsilon_i$$

where ΔOutmig_i is the change in the number of out-migrants in village i between year 1997 and 2002.¹⁰ YGDZ_i is a binary variable that indicates whether *Yigong-daizhen* projects had been implemented in village i between 1998-2002.¹¹ $\text{Village}_{i,1997}$ controls for socio-economic, demographic, governance, and transportation related village level characteristics in year 1997 that we take as proxy for various push factors of migration. These include net income per capita (*yuan* in natural log), squared income per capita (*yuan* in natural log) in 1997, the number of illiterates, total population, the distance from village committee seat to township government seat, the number of fellow villagers working at the upper government (township government,) and whether there are tarred roads passing through the village.¹² As there were 19 types of public investment projects in the surveyed villages, $\text{Project},k$ controls for project type fixed effects, that is, $\text{Project},k = 1$ if a type k project had been implemented in the villages during 1998-2002, otherwise $\text{Project},k = 0$. $\text{Province},k$ controls for provincial fixed effects. ε_i is an error term.¹³

In order to deal with the endogeneity of the non-random placement of *Yigong-daizhen* projects, we will additionally provide estimates based on Two-Stage Least Square to instrument for the placement of *Yigong-daizhen* projects. Specifically, the first stage is:

$$\text{YGDZ}_i = \alpha' + \lambda_1 \text{Village}'_{i,1997} + \lambda_2 \text{Village}_{i,1997} + \sum \gamma'_k \text{Project},k + \sum \phi'_k \text{Province},k + \varepsilon_i$$

where $\text{Village}'_{i,1997}$ includes a set of village characteristics that are likely to be exogenous,

but potentially correlated with the implementation of *Yigong-daizhen* projects. These include land acreage, terrace acreage, forest acreage, the number of households with access to tap water, the number of households with access to telephone, the distance from the village to road and the proportion of flat areas in the village.¹⁴ As we are not aware of any official policies regarding the selection process of *Yigong-daizhen* programs into villages *ex ante*, we aim to include a variety of exogenous village characteristics in the first stage estimation to capture the relationship, most of which are geographical variables. The first set of such instruments include factors such as the acreage of land, terrace and forest, and the proportion of flat areas in the village, which describes the topography of the surveyed villages. First, topography may affect the scale and productivity of agricultural production. For example, villages with larger acreage of land are likely to be more devoted to agricultural production. Villages with proportionally more flat areas in the village are more likely to have higher productivity in the agricultural sector. Furthermore, the number of surplus labor is likely also dependent on topography, which in turn impact the likelihood of the placement of *Yigong-daizhen* programs. The second set of instruments capture the remoteness of villages, such as the number of households with access to tap water, the number of households with access to telephone, the distance from the village to road. As remote villages are more likely to be poor and lack infrastructure, they are more likely to become the target of *Yigong-daizhen* programs.

The second stage is:

$$\Delta \text{Outmig}_i = \alpha + \beta_1 \widehat{\text{YGDZ}}_1 + \beta_2 \text{Village}_{i,1997} + \sum \gamma_k \text{Project}, k + \sum \phi_k \text{Province}, k + \varepsilon_i$$

where $\widehat{\text{YGDZ}}_1$ is the predicted value of *Yigong-daizhen* status from the first stage. Other

variable definitions are the same as the Difference-in-Difference specification.

V. Empirical Findings

Table 6 presents the empirical results for the impact of *Yigong-daizhen* projects on the migration patterns in the villages. Columns 1-4 display the results of OLS estimation of the difference in difference setup. Column 1 is the parsimonious specification without any control variables, Column 2 controls for village characteristics, Column 3 further controls for project type fixed effect and Column 4 controls for both project type and province fixed effects. Column 5 displays the result of the 2SLS estimation. It can be seen from the first row of Table 6 that the introduction of *Yigong-daizhen* projects had a positive and significant impact on the number of out-migrants in the village. After controlling for village characteristics in the year 1997 and the types of public project in the village, the introduction of *Yigong-daizhen* projects on average led to an increase of around 28 local laborers migrating out in the subsequent years as shown in Column 3. The significance and magnitude of coefficients decrease after controlling for provincial fixed effect. But the p-value of the coefficient on *Yigong-daizhen* projects is only slightly above 0.10 ($p=0.102$.) While for the 2SLS estimation, the coefficient on *Yigong-daizhen* is much larger than the OLS estimates, which may be attributed to a relatively low F statistic (7.17) in the first stage. But the coefficient is significant at the 0.1 level after controlling for types of project and province fixed effect.

In addition to the main coefficient related to the impact of *Yigong-daizhen*, the coefficients on village characteristics are of interests as well. For example, the linear term of per capita income in year 1997 is significantly positive, while the squared term of per capita income is

significantly negative, which suggests that there exists an inverted U-shape between per capita income and migration probability. The estimation of turning point is consistently around 615 *yuan* according to column 3 and 4. Furthermore, and as should be expected, higher population leads to more out-migrants in the village. Better road access also encourages out-migration.

Table 7 exhibits OLS estimation results by different income quartiles. As 2SLS estimation reports low first-stage F statistic in these sub-sample estimates due to insufficient observations, we do not have confidence in the 2SLS estimation thus do not report the results here. The coefficients for *Yigong-daizhen* are positive and significant for the second and third quartile by income in 1997 without controlling for provincial fixed effects. In addition, the magnitude of the coefficient for the third quartile is larger than its counterpart in the whole-sample estimation. These estimates provide some evidence on credit constraints as the households neither too poor nor too rich are the most likely ones to migrate out given the cash income from the public work projects. A potential drawback of the by-quartile regression is that sharp decrease in the number of observations per regression. Indeed, once separated by quartile, the *Yigong-daizhen* coefficient is no longer significant after controlling for provincial fixed effects, though the sign of the estimated coefficient remain positive for all except the second quartile.

Table 8 presents the results concerning ‘increasing productivity’ and ‘reducing cost’ hypotheses. Panel A and B test the hypothesis of ‘increasing productivity’ as a mechanism of *Yigong-daizhen* projects. In Panel A, we use a restricted sample including villages with five types of ‘productivity improvement’ projects: irrigation system improvement, drainage system

improvement, soil improvement, small-scale water conservation and terrace construction projects. We exclude projects which may not have effects in the short run, such as school and clinic construction. In addition, we exclude the Grain for Green projects as they mainly benefit the downstream villages. In Panel B, we use the complementary set of the restricted sample in Panel A as a comparable group.

The findings in Panel A suggest that the impact of *Yigong-daizhen* on the number of out-migrants in the villages is uniformly positive and significant in the four specifications. Comparing panels A and B, the coefficients do not seem to differ significantly in the two panels without controlling for provincial fixed effects. However, the impact of *Yigong-daizhen* is not significant in Panel B after adding the provincial fixed effects, in stark contrast with the estimation in Panel A. This lends some credibility to the hypothesis that productivity improvement is a key mechanism by which public work projects impact the behavior of potential migrant workers. Specifically, an increase in local productivity will lead to an increase of domestic wage, which may help release the credit constraint of the poor, thus enabling more migration.

Panel C of Table 8 only includes the villages with road and bridge construction projects during 1998-2002. These villages are more likely to experience migration cost reduction through better connectivity to neighbor cities and villages. The coefficients on *Yigong-daizhen* in the villages with newly constructed roads are positive and larger than the other villages, though the coefficients are not significant for both groups after controlling for province fixed effect. While in panel D, which includes only the villages without such migration cost reduction projects, the impact of *Yigong-daizhen* on outmigration is not significant at all. Thus,

the above estimates provide us with some confidence that cost reduction may be a channel for the positive impact of *Yigong-daizhen* projects on the flow of out-migrants.

VI. Conclusion

In this paper, we present the impact of public work schemes in China, *Yigong-daizhen*, on the outmigration of labor at the village level. The results show that the introduction of *Yigong-daizhen* projects in the villages stimulates the outflow of migrant workers from affected villages. The impact of such projects is even larger after accounting for the endogeneity of *Yigong-daizhen* placement. These results are consistent with the predictions of a model of migration behavior in the presence of significant migration cost, and credible market imperfection (Qin 2011). The positive impact of *Yigong-daizhen* continues to be robust upon controlling for potential heterogeneity of program effect across income quartiles. Specifically, we find evidence suggesting that the impact of *Yigong-daizhen* on migration is most important for the middle class, which is in consistent with the inverted-U shaped relationship between migration and income level in the presence of capital market imperfect. The robustness of the positive impact of *Yigong-daizhen* remains upon accounting for heterogeneity in program characteristics, most important in villages with productivity improvement projects (such as construction of irrigation system) and cost reduction projects (such as road construction.)

Our findings also reveal two observations that suggest that the present set of results should be interpreted with caution, and that additional research with better identification techniques and broader data coverage should be encouraged. In particular, in regressions that

do not control for the endogeneity of program selection, the significance (but not the sign with one singular exception in Table 7) of the impact of *Yigong-daizhen* on out-migration is sensitive to the introduction of provincial fixed effects. However, upon accounting for endogenous program selection, the impact of *Yigong-daizhen* on outmigration continues to be positive and significant. Future research with ideally a broader data coverage should devote particular attention to possible province-specific effects of the impact of *Yigong-daizhen* on outmigration. In addition, for the 2SLS regression in Table 6, the first stage F statistic is 7.17, which is slightly lower than the commonly accepted criterion of 10 (Angrist and Pischke, 2008). As well, with a substantially reduced number of observations in each income quartile and each project panel, the 2SLS estimations cannot be applied in the restricted (income quartile specific / program characteristic specific) samples for the F-statistics are too small. Alternative identification techniques with better instruments and broader data coverage, for example, should be applied in future research.

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Notes

1. Betcherman et al. (2004) summarises the impact evaluation results of 20 public work programs worldwide. The 20 public work programs cover transition countries, developing countries and developed countries. The results concerning the impact on employment and

earnings are both mixed. Among the 18 studies with impact evaluation on employment, seven of them find that public work programs have positive impact on the level of employment. For example, Walsh et al. (2001) investigate the Temporary Employment Program in the period of 1998 to 1999 in Bulgaria and find that there is a 2.5 per cent net impact of improving the chance of the unemployed to have a regular job.

2. Suggested by Betcherman et al. (2004), of the two studies with impact evaluation on earnings (Benus and Rodriguez-Planas, 2002; Jalan and Ravallion, 2002), the evaluation evidence regarding to the impact of public works on earnings is mixed for the transition and developing country programs. For example Benus and Rodriguez-Planas (2002) find that in Romania, the Public Works Community Job Creation Program has no impact on wages in the period of 1999-2001. While according to Jalan and Ravallion (2002), the Trabajar program in Argentina significantly lifts up the net income of the poor participants, where the percentage net gain for the poor 5 per cent is 74%. Gaiha (1996b) analyzes the impact of EGS on the wages of the poor in Maharashtra, India. Program participation is shown to bring significant positive effect on agricultural wages of the poor possibly since EGS enables them to bargain for higher agricultural wages by improving their fall-back position. Finally, the study also finds that EGS program has an income stabilization effect in agriculturally slack periods.
3. Gaiha (1996b) examines the targeting precision of the EGS program. It is expected that EGS program is designed to help the poor by providing them job opportunities. However, he finds that the targeting of EGS is no better than the general labor market. In other words, the share of the poor among EGS participants is close to the share of the poor in the labor force. This evidence is further confirmed in Gaiha (2000). In addition, there are more male participants in EGS with a significantly higher wage than the female participants. Another interesting finding with respect to the participation of the EGS is that the poor people turn to depend less on EGS, or to be more likely to withdraw from EGS when the overall economic condition gets better.

4. Park et al. (2002) studies the targeting effectiveness of the three main poverty reduction programs, namely the *Yigong-daizhen* program, the subsidised loan program and the budgetary grant program. They find that for both *Yigong-daizhen* program and the subsidised loan program, the amount of fund allocation to poor counties is not significantly correlated with income levels. Only the budgetary grant program is progressive. In addition, they find that being designated as a poor county increases the growth in rural income per capita by 2.28 per cent per year during the period of 1985-1992 and 0.91 per cent during the period of 1992-1995.
5. Zhu and Jiang (1995) is the only paper that estimates the impact of *Yigong-daizhen* program in China with data from three counties. This study finds that *Yigong-daizhen* projects have improved the income of participating households. However, they simply compare the difference of average income per capita between participating and non-participating households without controlling for village characteristics and accounting for program placement endogeneity.
6. This question has been addressed by Ravallion (1991) for example in the Indian context. Specifically, the initial purpose of the Maharashtra Employment Guarantee Scheme was to discourage worker migration in the slack seasons and drought affected years since some workers would not return in the harvest seasons. Also see Naomi (2008) for evidence on the potential of the National Rural Employment Guarantee Scheme in India on outmigration propensities.
7. Kanbur (1981) suggests that a rural development program which increases the rural income may indeed increase migration in the villages with imperfect credit market, as the poor now have more money to spend on migration if the gain from migration is greater than the earnings from local employment. Qin (2011) narrows down the concept of rural

development programs to public work schemes and provides a theoretical framework to analyze the impact of such programs on interregional movements of labor.

8. The objective of Grain for Green projects is to increase forest cover and prevent soil erosion on sloped cropland (Uchida et al., 2005).
9. There are three main differences between *Yigong-daizhen* projects and other public projects in rural China. First and foremost, the funding of *Yigong-daizhen* projects comes from the central government, while the funding of the other public projects comes from either the upper government or the villages themselves. Second, the laborers hired by *Yigong-daizhen* projects are the local villagers, unlike the other public projects which generally outsourcing to companies outside the village. Third, as one of the pro-poor policy, *Yigong-daizhen* projects are likely to be placed in villages with more poor population and less infrastructure (NDRC, 2005).
10. In the questionnaire, there is a question asking “How many villagers worked outside, and lived outside in 1997 and 2002.” We use the change in number of migrants from 1997 to 2002 in village i as the measure of ΔOutmig_i .
11. In the questionnaire, whether *Yigong-daizhen* program had been implemented in the village can be detected from the question “the source of funding of the public investment projects.” If the source of funding of any of the public investment project in village i was from *Yigong-daizhen* program, then the variable YGDZ_i will be coded as “1” for village i , “0” otherwise.
12. In China, each township consists of several administrative villages. And each administrative village consists of several natural villages governed by village committee. The distance from the village committee seat to township government seat measures how

isolated a natural village is, which is likely to affect the placement of public projects.

13. The 19 types of public projects are: roads and bridges construction, school construction, clinic construction, drinking water facility provision, irrigation system improvement, drainage system improvement, electricity infrastructure construction, telephone installation, cable TV or loudspeaker installation, soil improvement project, small scale water conservation, terrace construction, environment improvement project, forest closure project, public forest planting, Grain for Green project, meadow construction, recreational center construction and others.
14. Angrist and Krueger (2001) suggest that using probit or logit as first stage in two-stage least squares is not necessary and may even do some harm. Specifically, if the probit or logit model does not reflect the correct first-stage functional form, the second stage estimation will not be consistent. Instead, using a linear regression for the first-stage estimates generates consistent second-stage estimates even with a dummy endogenous variable.

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Table 1. Basic Background of Yigongdaizhen Projects in China

Projects	Period	Investment (billion yuan)	Achievement
Rural Land Construction and Irrigation System Construction	1985-1995	7.3	Developed new terraces: 21 million mu; Improve low fertility land: 14 million mu; Improve irrigation: 51 million mu.
Road Construction	1985-1995	10.05	Improve rural roads: 214.4 thousands kilometers
Drinking Water Supply Facilities	1985-1995	3.5	Provide drinking water supply for 40.9 million people and 33 million livestock
Forrestry and Meadow Maintenance, Small-Scale Water Conservation	1985-1995	2.7	Tree Planting: 22.7 million mu; New and improved meadow: 10 million mu; Small-scale water conservation: 28 thousands square kilometers
River and Lake Conservation	1991-1995	8	2 billion yuan has been invested annually since the flood in 1991 to improve the water condition of several important river and lakes
Rural Land Construction and Irrigation System Construction	1995-2000	10	Rural land construction: 30 million mu; Improve irrigation: 40 million mu.
Drinking Water Supply Facilities	1995-2000	3.5	Provide drinking water supply for about 40 million people and 30 million livestock
Road Construction	1995-2000	9	Improve rural roads: around 100 thousands kilometers
Small-Scale Water Conservation	1995-2000	1.5	Small-scale water conservation: around 30 thousands square kilometers

Source: Documents issued by the National Development and Reform Commission referring to Yigongdaizhen projects, 1985-1995; 1995-2000

Table 2. Chinese Government investment in Yigongdaizhen Projects, 1984-93

Scheme Number	Planned Period	In-Kind Goods Invested	Converted Value of the Goods
1	1984-87	Cereals, cotton and cloth	2.7
2	1989-91	Medium- and low-grade consumer goods	0.6
3	1990-92	Industrial goods	1.5
4	1991-95	Foodgrains	5
5	1991-95	Foodgrains and industrial goods	10
6	1993-97	Cereals, cloth, edible oil, medium- and low-grade consumer goods	10

Source : Zhu and Jiang (1995) Table 4.1

Table 3. Summary of Statistics of All Public Projects (N=10,967)

Project	Number of Projects	Average Investment (yuan)	Average Labor Used	Benefit Household
Roads and Bridges	1,556	39101.51	1892.04	459.15
School Construction	983	24168.96	358.22	--
Build Clinic	203	2852.65	64.06	--
Drinking Water	777	29470.35	786.87	286.39
Irrigation System	725	22813.71	516.2	234.96
Drainage System	239	33725.56	433.33	367.33
Electricity	1,939	333854.8	541.42	382.16
Telephone	1,316	450116.2	146.16	205.52
Cable TV or Loudspeaker	771	334177.7	107.73	245.27
Soil Improvement	84	57140.71	1982.52	252.76
Small-Scale Water	191	66634.66	1979.7	224.9
Terrace Construction	216	32158.47	5516.6	124.1
Environment Improvement	181	38186.09	457.57	274.5
Forest Closure	314	19046.14	831.86	225.21
Public Forest	80	18421.82	822.28	366.2
Grain for Green	1,092	87473.31	1429.87	139.63
Meadow Construction	25	99562.75	356.25	54.24
Recreational Center	275	12149.46	105.26	303.9
Not Indicated	178	64934.41	240.33	294.99
All Sample	10,967	158918	887.33	262.95

Table 4. Summary of Statistics of Yigongdaizhen Projects (N=549)

Project	Number of Projects	Average Investment (yuan)	Average Labor Used	Benefit Household
Roads and Bridges	148	18511.72	2406.39	530
School Construction	41	13125.61	412.33	--
Build Clinic	7	2114.29	124.29	--
Drinking Water	56	12552	1007.27	246.13
Irrigation System	61	18196.33	893.53	298.58
Drainage System	15	9240	580	465.73
Electricity	70	36714.75	1320.78	494.35
Telephone	24	35027.27	1820.52	282.45
Cable TV or Loudspeaker	5	3320	130	784.6
Soil Improvement	16	16713.33	3942	394.88
Small-Scale Water Conservation	19	8894.74	2342.22	337.16
Terrace Construction	23	8773.81	1785.7	135.32
Environment Improvement	15	6800	461.47	185.6
Forest Closure	9	1200	631.11	215.5
Public Forest	8	6325	1141.67	423.43
Grain for Green	24	7378.75	1755.96	249.17
Meadow Construction	0	0	0	0
Recreational Center	4	5700	107.5	725.5
Not Indicated	4	7250	533.33	935.33
All Sample	549	17249.05	1534.51	342.9

Table 5. Descriptive Statistics by Yigong-daizhen Status

Village Variables in 1997	All	Yigong-daizhen=1	Yigong-daizhen=0
Income per capita	1457.83 (973.91)	1367.91* (848.71)	1471.72 (991.29)
Total population	1439.40 (1072.93)	1664.12*** (1178.29)	1404.69 (1051.75)
Irrigated land (<i>mu</i>)	1107.36 (1724.88)	1184.27 (1754.51)	1095.48 (1720.38)
Proportion of land steeper than 25 degrees (%)	24.52 (29.30)	27.25* (31.84)	24.10 (28.87)
The distance from the village committee seat to the nearest tarred road	6.75 (23.63)	8.89* (55.85)	6.42 (12.86)
Distance from village committee seat to township seat	5.38 (5.30)	5.83 (6.08)	5.31 (5.17)
Number of fellow villagers working at township	2.32 (4.46)	2.76** (4.50)	2.25 (4.45)
Illiterate person in 1997	59.52 (110.94)	63.27 (87.32)	58.94 (114.16)
Any tarred road passing through your village? 1=yes; 2=no	1.68 (0.47)	1.71 (0.45)	1.67 (0.47)
Observations	2430	325	2105

Notes. *** denotes significant at the 0.01 level; ** denotes significant at the 0.05 level; * denotes significant at the 0.1 level. Standard deviation is reported in the parentheses.

Table 6. Impact of Yigong-daizhen Project on Migrant Labor

	Dependent Variable: Change of Migrant Labor (person)									
	OLS (1)		OLS (2)		OLS (3)		OLS (4)		IV (2SLS)	
Yigong-daizhen	41.05***	(8.04)	32.44***	(7.22)	28.48***	(6.83)	10.72	(6.56)	164.38*	(90.47)
<i>Village Characteristics in 1997</i>										
Net income (log)			6.39	(29.93)	51.13*	(29.04)	220.91***	(32.82)	120.70*	(66.50)
Net income (log) squared			0.13	(2.28)	-3.33	(2.20)	-17.20***	(2.51)	-9.37*	(5.14)
Total population (log)			49.73***	(3.08)	44.66***	(3.22)	23.31***	(2.73)	23.11***	(3.08)
Distance from village to town			-0.15	(0.27)	-0.18	(0.27)	0.00	(0.27)	-0.60	(0.48)
Villagers working in township (person)			0.24	(0.65)	0.09	(0.64)	0.49	(0.61)	0.22	(0.56)
Illiterates (person)			0.00	(0.02)	0.00	(0.02)	0.05*	(0.02)	0.04*	(0.02)
Access to road (dummy)			23.50***	(4.10)	23.29***	(4.11)	11.99***	(3.93)	10.26**	(4.80)
<i>Control for:</i>										
Types of project	No		No		Yes		Yes		Yes	
Province FE	No		No		No		Yes		Yes	
First-stage F statistic	na		na		na		na		7.17	
R-squared	0.02		0.19		0.20		0.31		na	
AIC	28886		28445.8		28408.3		28077.9		na	
N	2418		2418		2418		2418		2418	

Notes. *** denotes significant at the 0.01 level; ** denotes significant at the 0.05 level; * denotes significant at the 0.1 level. Robust standard errors are reported in the parentheses.

Table 7. Impact of Yigong-daizhen on Migration (by Income Quartiles)

		Dependent Variable: Change of Migrant Labor (person)							
		OLS (1)		OLS (2)		OLS (3)		OLS (4)	
		Lowest quartile by net income in 1997 (N=605)							
Yigong-daizhen		1.96	(5.45)	4.02	(5.14)	3.57	(4.81)	1.24	(4.83)
		Second lowest quartile by net income in 1997 (N=614)							
Yigong-daizhen		35.64**	(14.10)	26.95**	(12.00)	21.59*	(13.03)	-4.08	(9.84)
		Second highest quartile by net income in 1997 (N=599)							
Yigong-daizhen		79.60***	(15.68)	60.84***	(13.73)	44.05***	(13.27)	13.46	(13.37)
		Highest quartile by net income in 1997 (N=600)							
Yigong-daizhen		48.71**	(23.80)	21.79	(22.08)	17.87	(20.17)	10.29	(20.15)
<i>Control for:</i>									
Types of project		No		No		Yes		Yes	
Province FE		No		No		No		Yes	

Notes. *** denotes significant at the 0.01 level; ** denotes significant at the 0.05 level; * denotes significant at the 0.1 level. Robust standard errors are reported in the parentheses. The specifications are the same as reported in Table 6. Only the coefficient on Yigong-daizhen is reported due to space constraints.

Table 8. Impact of Yigong-daizhen on Migration (Hypothesis Tests on Productivity Improvement and Costs Reduction)

Dependent Variable: Change of Migrant Labor (person)								
	OLS (1)		OLS (2)		OLS (3)		OLS (4)	
Panel A: Restricted sample: have productivity improving project from 1998-2002 (N=1103)								
Yigong-daizhen	40.83***	(10.66)	34.69***	(9.77)	29.73***	(8.92)	15.06*	(8.40)
Panel B: Restricted sample: no productivity improving project from 1998-2002 (N=1315)								
Yigong-daizhen	41.45***	(12.13)	29.33***	(10.50)	25.31**	(10.75)	2.84	(10.38)
Panel C: Restricted sample: have road construction project from 1998-2002 (N=1520)								
Yigong-daizhen	47.82***	(10.26)	38.71***	(9.21)	35.59***	(8.74)	12.58	(8.50)
Panel D: Restricted sample: no road construction project from 1998-2002 (N=898)								
Yigong-daizhen	8.16	(8.42)	5.42	(7.95)	6.13	(8.27)	0.26	(8.14)
<i>Control for:</i>								
Types of project	No		No		Yes		Yes	
Province FE	No		No		No		Yes	

Notes. *** denotes significant at the 0.01 level; ** denotes significant at the 0.05 level; * denotes significant at the 0.1 level. Robust standard errors are reported in the parentheses. The specification is exactly the same as reported in Table 6. Only the coefficient on Yigong-daizhen is reported due to space constraints.