Access to Migration for Rural Households*

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Abstract

This paper exploits a unique feature of China's history, the "sent-down youth" (SDY) program, to study the effects of access to internal migration. We show that temporary migration due to the SDY program created lasting inter-province links. We interact these links with two time-varying pull measures in potential destinations. Decades after the SDY program ended, increased access to migration in cities which sent SDY leads to higher rates of migration from provinces where those SDY resided. We find that improved access to migration leads to lower consumption volatility and lower asset-holding. Furthermore, household production shifts into high-risk, high-return activities.

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1 Introduction

Migration offers a key form of arbitrage: especially for poor individuals, human capital may represent a large share of wealth, and migration allows this human capital to receive a higher return.[1] While much of the focus of the economic literature on migration has been on the impact of migration on migrants and on workers in receiving communities, the impact of migration opportunities on sending households and communities is less understood but extremely important for policy-makers in developing countries who are interested in reducing rural poverty and regional inequality. Using a novel identification strategy, our paper addresses the question of how changing incentives to migrate affect the economic choices and outcomes of agricultural households in communities sending the migrants.

We exploit a unique feature of China's economic environment to understand how opportunities for internal migration affect agricultural households: historical patterns of urban-to-rural migration during the "sent-down youth" (SDY) campaign. In this program, the government mandated the temporary resettlement of roughly 18 million urban youth to rural areas from 1962 to 1980.[2] Our strategy builds on previous papers that use historical flows to instrument for migration (Card 2001, Munshi 2003, Hanson and Woodruff 2003, Hildebrandt and McKenzie 2005, McKenzie and Rapoport 2007, Dinkelman and Mariotti 2016), but there are key advantages to our analysis in the Chinese context. One is that the program sent urban youth to rural areas temporarily; virtually all SDY returned to urban areas by the 1980s (Pan 2009), so we are able to examine whether ties persist once the original contacts have left. Moreover, whereas the previous research exploits connections determined by historical movements in the same direction, we examine the effect of urban to rural movements on subsequent *rural to urban* movements.[3] Furthermore, our findings contribute to the study of the role of interpersonal ties in driving economic growth.[4] To our knowledge, we are the first to demonstrate that the large-scale movements associated with the SDY program created lasting linkages between the provinces that sent and received SDY.

To address the concern that our cross-sectional measure of historical SDY flows may be correlated with other ties between origins and destinations, we interact the SDY flows with two time-varying pull measures for migrants. This allows us to absorb time-invariant correlations between sending and

[1] The potential income gains from rural-to-urban migration are substantial; the rural-urban wage gap is estimated to be 10% in China and as high as 45% in India (Munshi and Rosenzweig 2016).

[2] See Section 3.1 and Bernstein et al. (1977) for details on the SDY program.

[3] Another relevant feature is that the decision to migrate and the locations associated with the SDY were not choices of the migrating individuals; instead, the routes of this involuntary migration were chosen by government planners. However, given that we interact these historical flows with time-varying pull factors in urban areas, our identification strategy does not *require* exogeneity of SDY flows with respect to outcomes in the rural areas to which they were sent.

[4] Our findings are related to Burchardi and Hassan (2013), who show that interpersonal relationships between East and West Germany persisted over time and were an important driver of growth after reunification.

destination areas and recover causal estimates of the impact of incentives to migrate.[5] Building on Card and Lewis' (2007) work on Mexican migration to the United States, we use local labor demand shocks, as measured by shocks to GDP in industries that employ a lot of migrants, in destination provinces. This methodology is widely used exploiting local labor demand shocks and historical migration patterns between states in Mexico and the United States. Here, following the same idea, we use inter-provincial SDY flows interacted with time-varying labor demand shocks in potential destinations to examine internal migration within China.

The second pull factor that we exploit is recent variation in the ease of migration generated by province-level reforms in the *hukou* system that allowed some migrants to register and receive social services in urban areas.[6] As discussed in Section 3.2, several other papers have also used variation in the *hukou* system to study migration; to our knowledge ours is the first to use its interaction with ties created by the SDY program. This allows us to use cross-province variation while relaxing the assumption made in the previous literature that timing of *hukou* reforms in a province is orthogonal to economic conditions in that province.

Examining two sources of variation that affect the incentives to migrate has several advantages. First, it allows us to examine different margins of selection into internal migration. The labor demand shocks are year-to-year fluctuations and represent changes in the short-run returns to migration. In contrast, the *hukou* reforms are relatively rare, but persistent, changes to the long-run cost of to migration. This comparison allows us to understand how the benefits and barriers to migration affect the outcomes of interest. Second, the two sources of variation are quite independent. Given that each requires a different set of assumptions (which we discuss below), the fact that both pull factors yield qualitatively similar conclusions acts as an informal over-identification test.

We combine our key regressors, the interaction of the SDY flows with the two migration pull factors, with outcomes from a detailed panel data on production activities of rural households from the Chinese Ministry of Agriculture. Our paper is among the first that analyzes the effect of incentives to migrate on outcomes related to agricultural production decisions of rural households. There are several reasons that one might expect production decisions to change when households have better access to migration opportunities. One mechanism is a wealth effect, wherein migrants' earnings increase relative to what they would have earned in the absence of migration and this income is shared

[5] Other previous work on migration has attempted to overcome the associated selection problems using various strategies: controlling for observable differences (Adams 1998), propensity score matching (e.g., Acosta 2011), natural experiments (e.g., Clemens 2010, McKenzie et al 2010), randomized experiments (e.g. Bryan et al 2014), or using instrumental variable strategies based on exogenous factors such as shocks at the migration destination (e.g., Yang 2008).

[6] See Section 3.2 and Chan and Zhang (1999) for details on the *hukou* system.

with households via remittances. A positive wealth effect may lead to an increase in leisure and a corresponding decline in total production. Alternatively, a negative wealth effect is possible, due to the cost of migration itself or the loss of a productive household member (if that member's wages are not fully shared with the non-migrating household members). A second possible mechanism is an insurance effect: the migrants are exposed to different shocks than the agricultural households that they left, and this diversification allows households to shift into riskier activities (Rosenzweig and Binswanger 1993). Alternatively, migration itself may be risky (Bryan et al. 2014), so rural households' portfolios could shift *away* from risky activities.

Interestingly, our results are very similar regardless of whether we use the variation driven by increased returns to migration opportunities or by lowering the barriers to migration. We find that increased access to migration leads to an increase in the level of rural households' consumption and a decrease in the variability of consumption. Agricultural production decisions also change, with a shift towards riskier activities including animal husbandry and fruit farming. These results are consistent with a positive wealth effect or with insurance derived from having a migrant working outside of the household. However, we also see a substantial fall in assets without a corresponding fall in income or labor. Similar to the findings of Kaboski and Townsend (2011) where an expansion of credit in Thailand led to a fall in assets, the results on assets in our setting are consistent with the interpretation that households decrease their buffer stock savings in response to improved access to insurance via migration.

The results are consistent with prior research suggesting an insurance mechanism related to migrants. Rosenzweig and Stark (1989) show that in rural India, internal migration for the purpose of marriage facilitates consumption smoothing by spreading family networks over locations with less covariate weather shocks. Using Tanzanian panel data, de Weerdt and Hirvonen (2012) find that migrants insure non-migrants, but not the other way around. Giles and Yoo (2007) use long lags of rainfall to instrument for the size of the migrant network, and show that households with a larger migrant network engage in less precautionary savings. More recently, Morten (2013) uses a structural model to examine the interaction between internal migration and insurance in rural India. Our setting is novel, however, in that we have detailed data on the productive decisions of rural households, and can examine how these decisions change due to improved access to migration.

In addition to the production outcomes that we examine, we are able to offer a new perspective on the impact of migration on the well-being of remaining household members. Our panel data set spans eight years, and the relatively long time frame allows us to look at measures of welfare, such as consumption smoothing, which are difficult to study in shorter panels. Prior research has demonstrated

that remittances received from migrants correspond with an increase in remaining household members' income, asset ownership and consumption of normal goods including education and health.[7] However, other research suggests that migration may generate negative impacts on sending families stemming from the loss of a family member and household laborer.[8] Prior papers also find mixed evidence on children's education (Antman 2012, Cox-Edwards and Ureta 2003, Yang 2008, McKenzie and Rapoport 2011, Dinkelman and Mariotti 2016) and adult employment of remaining members (Funkhouser 1992, Yang 2008, Amuedo-Dorantes and Pozo 2006). Relatedly, Gibson, McKenzie and Stillman (2011) find that in the short-run, in Tongan households in which a member won a lottery to migrate to New Zealand, income falls as does asset ownership and access to finance, suggesting that migration may be costly to remaining households in the short run.

Finally, we contribute to the growing literature on internal migration (e.g., Beegle, de Weerdt and Dercon 2011, Bryan et al. 2014, Bazzi et al. 2016). While there exists a larger literature on international migration, there are many reasons to believe that impacts for international migration cannot be simply extrapolated to internal migration. Internal migration is more often short-term and over smaller physical distances, so the ease of and incentives for remitting may be greater, potentially yielding greater benefits for non-migrating household members. On the other hand, income differentials are likely smaller for internal than international migration, and the correlation between earnings of migrants and their sending households may be higher.[9] Questions related to internal migration are highly relevant: of an estimated 1 billion migrants worldwide, almost 75% are internal migrants (Klugman 2009). Moreover, the form of internal migration we study, inter-provincial migration, is highly relevant in China: according to 2010 Census data, 50% of internal migrants were inter-provincial migrants (Liang 2012).

2 Conceptual framework

There are several channels through which the improved access to migration might affect rural households. This paper focuses on two possible channels: wealth effects and insurance effects.

If migrants provide remittances to household members who remain in the origin communities, this increase in wealth can lead to more consumption by the rural households. If households were not credit

[7] See Rapoport and Docquier (2006) for a good review on this literature.

[8] There are also other potential difficulties associated with split families, including problems with hidden income (Joseph, Nyarko and Wang 2014).

[9] The extent of potential negative effects on non-migrants, such as divorce, isolation between parents and children, and negative spillovers on villages due to the loss of prime-aged workers, may also differ between international and internal migration.

constrained prior to migration, because leisure is a normal good, income earned by rural household members, and their corresponding investment in agricultural production, may fall. If households were credit constrained prior to migration, the hours worked and earnings of rural household members may rise as the migrant may be able to finance higher investment; moreover, if investment exhibits fixed costs or nonconvexities, nondurable consumption may fall.[10] If households exhibit decreasing absolute risk aversion, such as in the commonly-used constant relative risk aversion (CRRA) utility function, an increase in wealth will be associated with increased investment in high-risk, high-return assets. On the other hand, if the remittances sent by the migrant are less than the amount that the migrant contributed to household earnings before migration, migration may cause a *negative* wealth effect for households and a corresponding decline in their consumption and risk-taking.

In addition to a wealth effect, there may be an insurance effect from migration given that migrants' income will typically be uncorrelated or less correlated with the income of the remaining household members; in other words, the overall portfolio of household activities becomes more diversified when a member migrates. If migrants can provide state-contingent remittances, gifts or loans (de Weerdt and Hirvonen 2012), this increases the household's ability to insure risk associated with their income. The insurance from having a migrant, in turn, may lead to increased investment in high-return, risky activities, if the household was not previously able to insure income risk fully (see Karlan et al. 2014). On the other hand, insurance provided by migrants may reduce households' investment due to a reduction in buffer-stock savings (Deaton 1991). Moreover, migrants' income may itself be risky (Bryan et al. 2014). Rural households may be exposed to the risk faced by migrants either directly, because they provide transfers to migrants, or indirectly, because they receive reduced remittances from migrants when migrants' income is low. If households are exposed to risks faced by migrants in a way that increases the total risk they face, they may reduce the riskiness of their own production activities, potentially at the cost of accepting lower average returns (Binswanger and Rosenzweig 1993).

The preceding discussion was framed in terms of the effect of migration; however, anticipation of the ability to send a migrant in the future may cause rural households to change their behavior even before sending a migrant. If migration is a valuable *ex post* smoothing strategy (Morten 2013), households can increase investment in risky assets and/or liquidate buffer stocks even before sending a migrant. On the other hand, if households need to save up for migration, they may reduce consumption and/or increase labor supply prior to sending a migrant. For these reasons, our empirical analysis

[10] Banerjee, Karlan and Zinman (2015) show how access to credit may cause consumption to fall if nondivisible investment increases; the effect of remittances is similar.

will focus on the effect of changes to access and to the returns to migration rather than the effect of migration *per se*; thus, we will report intent to treat effects rather than treatment on the treated effects.

Given the theoretically ambiguous effects of access to migration on investment, consumption, and welfare of rural households, empirical evidence is needed. The remainder of the paper will attempt to shed light on the mechanisms that are relevant in the context of agricultural households in China.

3 Institutional background

3.1 The sent-down youth policy

Between 1962 and 1978, nearly 18 million urban youth, mainly aged 16 to 20, were sent to rural areas to live and work. These youth were referred to as "sent-down youth" or *zhiqing*. The policy's official goal was to promote rural development and to have urban bourgeois youth learn from living in rural poverty; an underlying objective appears to have been to address high urban unemployment (Bernstein et al. 1977, Gu 1997). Some sent-down youth were sent to rural areas near their home city, but others, especially those from large cities, were sent to other provinces, sometimes thousands of kilometers away. In total, 1.5 million sent-down youth were sent outside their home provinces. Some sent-down youth stayed only a year or two, while others stayed for more than a decade before the policy was discontinued in 1979. On average, they stayed 3 to 4 years and performed manual, agricultural labor (Bernstein et al. 1977). While small numbers of sent-down youth stayed in the rural areas they were sent to, the vast majority (over 90%) returned to the urban areas from which they came (Zhou and Hou 1999).

We investigate the possibility that receiving sent-down youth (SDY) from a large city may create personal connections and knowledge about that city which may persist over time and increase the desirability/salience of that city as a possible migration destination. For instance, Yunnan received 56,600 SDY from Shanghai, which may have created connections or provided information that facilitated the subsequent voluntary migration of Yunnanese people to Shanghai. Marriage rates between local residents of the rural areas and SDY from urban areas provide some suggestive evidence that the SDY formed strong bonds with locals during their stay; data from a government conference report on the SDY in 1978 suggests that about 7% of the sent-down youth remaining in rural areas in 1978 were married to local individuals in the rural areas (Gu 2009). In addition, there is anecdotal evidence that ties due to SDY flows persisted over time. For example, *Nie Zhai*, a novel written by a former SDY, Xin Ye, and later adapted into a television series, depicts the persistence of sent-down youth

ties. The novel and show focus on children of SDY who remained in rural areas, and who later went to Shanghai to look for their relatives.

While previous economic research has examined parental choices over which child to send-down (Li, Rosenzweig and Zhang 2010) and the impact on being sent down on the outcomes of the individuals directly experiencing the migration (Fan 2015, Meng and Gregory 2002, Zhou 2014), to our knowledge, we are the first to explore the extent to which migration patterns associated with the sent-down movement generated lasting connections between rural and urban regions.

3.2 *Hukou* system

China's *hukou*, or household registration system, was set up in 1950s as a system of monitoring population flows (Chan and Zhang 1999). After the implementation of the Communist Party's economic plan called the Great Leap Forward (1958-60), the *hukou* system was repurposed to control rural-to-urban migration given the government's desire to keep food prices low and provide welfare benefits for urban residents. While the first constitution of the People's Republic of China (PRC), issued in 1954, guaranteed citizens the freedom to migrate and settle in the area of their choice, the subsequent issuance of "*Hukou* Registration rules of the PRC," issued in January 1958, began the dual-*hukou* system which divided people into those holding a rural *hukou* and those with an urban *hukou*. This essentially voided the "freedom to migrate" specified by the first constitution.[11]

An individual's *hukou* determines their eligibility for jobs, schooling, housing, and other rationed goods in a specific city or county. In particular, an individual with a rural *hukou* cannot legally work for a state-owned enterprise or the government or receive state services in an urban area. Thus, most rural *hukou* holders can only work in the city as "temporary workers" (*linshi gong*), and do not get insurance, retirement benefits, housing subsidies or other allowances and are not subject to the same labor protections as urban *hukou* holders. Moreover, many private firms in urban areas are reluctant to permanently hire an individual without the corresponding urban *hukou*.

Initially, it was impossible for the holder of a rural *hukou* to convert to an urban *hukou*. However, in July 1985, the Ministry of Public Safety issued the "temporary regulation on the town and city *hukou* registration system," which allowed conversions of rural to urban *hukou* (*nongzhuanfei*); however, this was quite rare in this period.[12] The annual quota (*zhibiao*) for *nongzhuanfei* was miniscule at 0.02%.[13] In other words, a city with 10,000 city *hukou* holders could allow 2 rural people to obtain a *hukou*.

[11] The first constitution was revised in 1975 and the "freedom to migrate" clause was deleted.

[12] Furthermore, a worker who successfully obtains an urban *hukou* cannot necessarily get the same for their spouse or dependents.

[13] See http://www.mps.gov.cn/n16/n1252/n1657/n2107/96328.html (Accessed February 2015).

However, starting in the early nineties, provinces began to open the conversion process to more people. The nature and timing of these relaxed conditions varied across provinces and across time, providing a key source of variation that we exploit.

Several previous papers have inferred the effects of the *hukou* system on labor mobility using aggregate data (Bosker et al. 2012, Whalley and Zhang 2007) but have not used cross-province variation to address potentially confounding aggregate trends. An exception is Sun, Bai and Xie (2011) who code and use variation across provinces and time in reforms of the system, as we do; they find that *hukou* reforms adopted by a province correspond to an increase in intra-provincial migration within that province. Unlike Sun, Bai and Xie (2011), the identification strategy in our paper does not rely on the exogeneity of within-province *hukou* reforms.[14] Rather, we show and exploit the idea that *hukou* reforms in a province which historically sent SDY to another (recipient) province correspond to subsequent increases in migration rates between the provinces in the reverse direction of the SDY flow. In a concurrent working paper building on an earlier national reform, de Brauw and Giles (2014) exploit differences in the timing of access to national identification cards; they argue that these cards make it easier for rural residents to temporarily work in urban areas. Their strategy relies on the assumption that the timing of access to identification cards is exogenous to other economic conditions within provinces that affect migration.

There are many anecdotes supporting the hypothesis that individuals migrated in response to the provincial-level *hukou* reforms. This is also true among individuals who could not immediately qualify to apply for an urban *hukou*. For example, after a *hukou* reform in Guizhou in 1997, "36-year-old Mrs. Aifen Wang left her hometown that year and opened a power mill in Honghe city. Since then, she kept saving for 10 years. After a more aggressive hukou reform in Honghe city in 2006, she bought an apartment in the city and became *chengliren* [a resident with urban *hukou*]" (Xue and Chu 2007).

4 Data

Our analysis combines outcomes from a household-level panel data from the Ministry of Agriculture with variation at the province-level from data sets that we assembled on historical SDY flows, *hukou* reforms and labor demand shocks. The SDY flows data is a cross-sectional data set of the total interprovincial flow of individuals under the program, while the data on *hukou* reforms and labor demand shocks vary over time and province.

[14] Indeed, we demonstrate that the timing of a province's *hukou* reforms is correlated with other characteristics of the province.

4.1 National Fixed Point Survey

Our primary data source for the outcomes of agricultural households is the National Fixed Point (NFP) Survey, a panel survey collected by the Research Center of Rural Economy (RCRE) of the Chinese Ministry of Agriculture, beginning in 1986. We use annual waves of data between 1995 to 2002 for data comparability as the questions and the structure of the survey changed substantially in 1995 and again in 2003. The data set used in our analysis covers over 14,000 households from 234 villages in 19 provinces.[15]

NFP villages were selected for representativeness based on region, income, cropping pattern, population, and non-farm activities. The NFP contains detailed information on household agricultural production, consumption, asset accumulation, employment, and income. Benjamin et al. (2005) provide a detailed description of the data and show evidence that the data are of good quality. Its particular advantages for our purposes are its panel structure and detailed data on household production decisions.

Over the period 1995 to 2002, the data only include household-level information. In other words, with the exception of a few characteristics of the household head (e.g., age and education), the data do not include individual-level characteristics. For example, we do not know the gender and education of each member of the household, but we know the number of household members, the number that are male and the number in each bin of education. Thus, if a household has four members, two of which are male and two that completed primary school, we do not know if the males were the ones to complete primary schooling. One major implication of this lack of individual-level information is that we do not know the individual identity of the household member who migrates. While we do not know the characteristics of the migrant, we do know whether or not any household members have migrated. We also do not know where exactly migrants go, or what kind of work they are engaged in. Finally, we do not have a good measure of remittances that the household receives.

The summary statistics for the NFP data are presented in Table 1, where there is one observation per household, corresponding to the first year that the household appears in the data. We present levels in the summary statistics for ease of understanding the magnitudes but the regressions use log measures.[16] We drop the top and bottom 1% of values to deal with outliers; however, the results in the paper are very similar if we do not drop outliers.

[15]The provinces are Chongqing, Gansu, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Liaoning, Ningxia, Qinghai, Shandong, Shanghai, Shanxi, Sichuan, Tianjin, Xinjiang, Yunnan, Xizang (Tibet) and Zhejiang.

[16]Given that some values of assets, consumption and income may be zero, the log measures are all measured as the log of the variable plus one. The results are all very similar if we use the inverse hyperbolic sine (Burbidge, Magee and Robb 1988) instead of the log.

To address the issue that household size changes mechanically with migration, we examine most outcomes in per capita terms. We calculate per capita values using the number of of residents in the household at the time of the survey, as reported by the survey respondent. To ensure that our results are not driven by the fact that migrants may not be reported as household residents if they are migrating at the time of the survey, we construct two additional measures of household size. The first adds one to the household size if the household reports that a member spent any days working as a migrant worker the past year. This is a conservative measure that will reduce per capita values of income and consumption; if our results are driven by migrant-sending households spuriously appearing smaller than they are, this measure will address the issue. A second measure assigns household members younger than 18 or older than 65 an equivalence weight of 0.5 relative to those aged 18 to 65. This will address any differences in the age structure between migrant-sending households and those who do not send migrants. The results using these two measures of household size, which are available on request, are very similar to the main results, confirming that our results are not driven by mechanical changes in household size or composition.[17]

Our key measure of migration is an indicator for whether a household member spent time working in a different county. While our identification strategy focuses on cross-province migration, we do not observe the exact location of migrants' work in our primary data set so we cannot distinguish migration within the province from migration across provinces or international borders.[18] While this adds noise to our measure of migration, it does not invalidate our identification strategy. It is important to note that the rate of inter-provincial migration is fairly high. According to the 2010 Census data, inter-provincial migrants constitute 50% of internal migrants in China (Liang 2012).

The base rate of migration in this population is not trivial: in the first year that they appear in the data, about 16% of households have a migrant. Households experience on average 30 days of a migrant working away from home. This includes the 84% of households who reported zero days of migration. Conditional on positive days of migration, the mean is 184 days.[19]

Total consumption is 508 RMB (or USD$64 at market exchange rates) per person in the base year.[20] We have several measures of household consumption in RMB. One sub-category of total

[17] This is as expected since, as discussed below, we do not see large differences in the household structure of migrant-sending and other households (see Appendix Table A.1).

[18] To address the limitation that we do not know the destination of the migrant in the main NFP data, we supplement our analysis with two data sets in which migrants report both their origin and destination provinces: the China Household Income Project (CHIP) in 2002 and the NFP from 2010 to 2012. We discuss these results in Appendix Section C.

[19] While partial-household migration is relatively common, total-household migration, as measured by attrition from our dataset, is very rare at 0.81% per year. If an entire family migrates in this period, they risk losing their land in the village, which may explain why this is a rare event.

[20] Over the year, households kept daily diaries of their consumption and the measures represent annual consumption of the household. This figure, which is lower than total income (discussed below), is likely to be a significant underestimate

consumption is food consumption. Food consumption represents about 50% of total consumption. Food consumption is broken down into staple and non-staple, where staple food includes corn, wheat, rice and beans and non-staple food includes vegetables, meat, seafood, oil, sugar, wine and condiments. About 56% of the value of food consumption is on these non-staple items.

The average per capita agricultural income in the sample (in the base year) is 2847 RMB (USD$356) per year.[21] Agricultural income makes up about 46% of the total income earned by these households.[22] Agricultural labor input is measured as the number of days that all of the members of the household and hired labor work in agricultural production divided by the number of workers in the household. The average for the sample is 167 days per worker. The number of household laborers averages 2.4 workers in the family. This measure does not include the migrant if the household has a migrant who is away from home at the time of the survey.

The average household owns about 1080 RMB of non-productive assets (durable goods that are not primarily used for production) per worker.[23] The average household owns 471 RMB of agricultural assets per worker and 98 RMB of industrial assets per worker.

We denote by "fruits" a bundle of items, including orchard fruits, pods and tea.[24] At baseline, 22% of households spent positive labor days on orchard fruits, pods and tea in the base year. Conditional on participating in these production activities, the number of days per worker that are spent on fruits is 29 days per year. Unconditional on participation, this number drops to 5.6 days per worker per year. Households earn an average of 120 RMB per worker per year in this category.

A majority (71%) of households worked in animal husbandry in their first year in the survey. Conditional on participation in these activities, households spend an average of 56 days per worker in this category. Unconditional on participation, the corresponding average is 42 days. Corresponding to the patterns in labor, households earn substantially more on average from animal husbandry than from fruits, pods and tea; they earned 699 RMB per worker from animal husbandry.

Finally, education is an indicator variable for whether the head of household has a middle school education or higher. Approximately half (47.5%) of household heads have at least this level of educa-

of true consumption because the NFP used procurement prices to value agricultural products that are both produced and consumed by the household (Benjamin et al. 2005). While we do not have data on procurement prices for our full sample period to adjust our regressions, we analyze this issue using data on prices collected from provincial statistical yearbooks for 1995 to 2000. Appendix Table A.5 demonstrates that ratio of procurement to market prices does not move significantly with our two sources of variation. Thus, this issue does not introduce bias into our estimates of the effects on consumption.

[21] Agricultural income includes products that the household consumes; they are asked to estimate the value based on the quota price of the products.

[22] This includes income from crops and plantation as well as from animal husbandry and fruits, pods and tea.

[23] This includes items like bicycles, furniture and electronics but does not include real estate. To be included, a durable asset must have at least two years of life and be valued above 50 RMB, or about USD$6.

[24] As we show in Table 9, fruit cultivation as well as animal husbandry are relatively risky activities.

tion.

We present the summary statistics broken down by households who ever have a migrant or not in Appendix Table A.1. Compared to those who never have a migrant, households who have a migrant between 1995 and 2002 are slightly better off in terms of income, assets and consumption in the first year that they appear in the data; this emphasizes the need for exogenous variation to identify the effects of migration opportunities. We do not observe notable differences in household structure.

4.2 Sent-down youth flows

For data on inter-province sent-down flows, we use data in the publication, "Statistics on sent-down youth in China," compiled by the Sent-down Youth Office of the State Council of China in 1983. We collect inter-province sent-down information for all of the provinces in our sample. We use the total number of people sent from one province to another across time: our measure of SDY flows is time-invariant. Appendix Table A.2 shows the total sent-down youth flows to the provinces in the NFP dataset aggregated over the sent-down youth period.

Our identification strategy relies on the idea that historical migration flows associated with the temporary relocation of urban youth to rural areas created lasting linkages across provinces. These lasting linkages can occur for several reasons, including the maintenance of networks created during the sent-down period and the transmission of information or attitudes about particular places. Appendix C.1 uses aggregated data to show that the sent-down flows between provinces predict interprovincial migration several decades later. This provides support for the idea that the SDY program created lasting linkages and emphasizes the suitability of using SDY flows in our identification strategy.

4.3 *Hukou* reforms

For our main analysis, we focus on two pull factors affecting the returns to migration. One is *hukou* reforms that occur in the provinces from which the sent-down youth originated. To compile data on the timing of each province's *hukou* reforms, we used an algorithm with specific combinations of keywords to methodically search through several databases that cover local laws and regulations in China. We focused on city-level reforms that would affect migrants from rural areas.[25] See Appendix Section A for more details on our algorithm for coding these reforms. Chinalawinfo, maintained by the Law School of Peking University, provides the most comprehensive coverage of local laws and regulations, covering about half a million local laws and regulations in China since 1949. We cross-checked three

[25] Thus reforms that targeted a very narrow population, such as individuals with PhDs, were omitted.

other data sources for local laws and regulation rules in China for completeness. Appendix Table A.3 details the reforms.

To check the quality of our *hukou* coding strategy, we cross-check our coding of the reforms by comparing the results of our algorithm with reforms identified in Sun, Bai and Xie (2011). They code the *hukou* reforms using *Baidu* (a Chinese search engine similar to Google), and one of the databases that we use, Chinalawinfo. Over the period in which our analyses overlap, 1998 to 2002, and for the provinces that overlap, our algorithm yields 100% of the provincial reforms that they identify. We find three additional reforms.

4.4 Migrant Labor Demand Shocks

Building on Card and Lewis' (2007) work on Mexican migration to the United States, we use local labor demand shocks in destination provinces as a pull factor for migrant labor. More specifically, we focus on GDP across two sectors, manufacturing and construction, in a destination province. We focus on these two sectors because, according data from the National Bureau of Statistics (2013), they are the top two industries in which rural migrants are employed. Thus, the level of economic activity in these two sectors is a measure of the potential demand for migrant labor in, and hence the attractiveness to migrants of, a given province. We collect this province-level data for each year corresponding to our primary data set.

Our construction of labor demand shocks differs slightly from Card and Lewis' primarily for data reasons. Using U.S. Census data, they construct the labor demand shock at the city level using first-differences over a ten-year period. However, we have province-level GDP information every year, so we construct our shock as deviations from the long-run average.[26] Second, Card and Lewis use employment as their demand measure, but official employment statistics in China have been found to be lower quality than official GDP statistics (Feng, Hu and Moffitt 2015), so we use GDP instead.

One possible concern is that there may be an endogeniety issue with this measure. For example, the arrival of migrants could lower the cost of labor and spurs growth. Card and Lewis address this by using lagged values to instrument for contemporaneous ones, in addition to the contemporaneous labor demand measure. The results in our paper do not change when we used lagged measures, so for parsimony, we focus on the contemporaneous measure.[27]

[26] This is constructed using fixed effects rather than the first-differences used in Card and Lewis (2007).

[27] We present the instrumented results in Appendix Table A.6. Using the lagged measures to instrument for current growth does not substantively change Card and Lewis' estimates either.

5 Identification and estimation

Our identification strategy isolates exogenous variation in barriers and returns to migration from province p using *hukou* reforms and labor demand shocks in provinces s which had previously sent SDY to province p. Thus, we exploit the interaction of cross-sectional variation resulting from the fact that SDY-recipient provinces received SDY in different magnitudes and from different destinations, and time variation resulting from *hukou* reforms and labor demand shocks in SDY-sending provinces. As a result, we are able to include both province- and year-fixed effects in our estimates. These allow us to flexibly control for many potential confounds. For instance, time-invariant ties between an SDY recipient province and its sending province(s) will be absorbed into the fixed effect for the recipient province. Relatedly, if SDY from s were sent to p because of pre-existing cultural or transportation links between s and p, any direct effect of these links on our outcomes of interest will be absorbed.[28] If a *hukou* reform or labor demand shock in a particular province makes it generally more attractive as a destination to migrants from all origins, this will be absorbed by year fixed effects.

5.1 Variation from the *Hukou* Reforms

We define $f_{s \to p}$ to be the historical level of SDY flows from urban areas in province s to rural areas in province $p \neq s$. Note that we are focusing on *hukou* reforms that occur in province s. We define h_{su} as an indicator for a *hukou* reform at time u in province s. The variable Z^{hukou} represents an interaction between the historical SDY flows from s to p and the contemporaneous *hukou* reforms in provinces s.[29] In other words, the main source identifying variation is defined as:

$$Z_{pt}^{hukou} = \sum_{u \leq t} \sum_{s} f_{s \to p} h_{su}. \tag{1}$$

Thus Z_{pt}^{hukou} is a cumulative weighted sum of all the *hukou* reforms that have occurred in provinces linked to p via SDY flows up until t, where the weights are the historical SDY flows from the reforming province to p.[30] Consider the simplest case, when there is only one reform in year $n \leq 2002$ (where 2002 is the last year in our main dataset) among the provinces s that are linked by historical flows

[28] Therefore, our identification strategy does not rely on random assignment of SDY to destinations. While we do not need this assumption, it is perhaps worth noting that the destinations of SDY were determined by which locations were prepared to accept SDY at different points in time and are likely to have been orthogonal to ties between sending and destination province.

[29] Appendix Section 4.2 uses two other Chinese data sets that provide information on both the origin and destination provinces of migrants to demonstrate the validity of the identification strategy.

[30] We also considered an alternative construction of SDY where we divided the SDY flows by the population in province p to capture the idea that interactions with SDY are higher if they are a larger fraction of the population. The sign and significance of the estimates shown in Appendix Table A.7 are similar to our main estimates in Table 2.

to p. Then the variable is equal to the quantity of SDY flows from s to p for the period from n to 2002 and 0 for the periods $t < n$. Now consider that case where in period $m > n$, there is a reform in another province s' that is also linked by SDY flows to p. In this scenario, in periods m and thereafter, the value of Z^{hukou} is the sum of the SDY flows from provinces s and s'. The key idea is that a reform in province s has a larger effect on the decision of households in province p to migrate to s if there were greater flows of SDYs, and hence stronger historical ties, between s and p.[31]

5.2 Variation from Labor Demand Shocks

As before, $f_{s \to p}$ is the historical level of SDY flows from urban areas in province s to rural areas in province p. Note that we are focusing on demand shocks in province s. We define d_{st} as the level of the demand shock at time u in province t. The variable Z^{demand} represents an interaction between the historical SDY flows from s to p and the contemporaneous demand shocks in provinces s. In other words, the identifying variation is defined as:

$$Z_{pt}^{demand} = \sum_{s} f_{s \to p} d_{st}. \tag{2}$$

Thus Z_{pt}^{demand} is a weighted sum of labor demand shocks occurring at t in provinces linked to p via SDY flows, where the weights are the historical SDY flows from the province s to p. Consider the simplest case, when there is only one province s that is linked by historical flows to p. Then Z_{pt}^{demand} is equal to the quantity of SDY flows from s to p times the demand shock in s at t.[32] Now consider the case where there are two provinces, s and s', that are linked by SDY flows to p. In this scenario, in period t, the value of Z_{pt}^{demand} is the weighted sum of the labor demand shocks in s and s', where the weights are the SDY flows from provinces s and s'. The key idea, which we test below, is that a demand shock in province s has a larger effect on the decision of households in province p to migrate to s if there were greater flows of SDYs, and hence stronger ties, between s and p.

[31] To make the construction of the identifying variation more concrete, in Appendix Section B we present the case of Shanxi, a province in Northwestern China, detailing the SDY flows to Shanxi and *hukou* reforms in the corresponding sending provinces.

[32] Note that Z_{pt}^{hukou} reflects a cumulative measure of *hukou* reforms, because reforms, once in place, were not rolled back during our sample period. Z_{pt}^{demand}, on the other hand, measures the "flow" demand, not the cumulative "stock," since only current demand reflects the ability of a migrant to work in province s at time t.

6 The Impact of Reforms and Labor Demand Shocks on Migration

We begin by estimating the following equation of the impact of the interaction between pull factors (*hukou* reforms and labor demand shocks) in province s interacted with SDY links from provinces s to p on migration:

$$migrant_{ipt} = \alpha + \beta Z_{pt}^{j} + \gamma_i + \delta_t + \epsilon_{ipt} \tag{3}$$

where $migrant_{ipt}$ is a binary variable for whether the household had a migrant in the past year, Z_{pt}^{j} is Z_{pt}^{hukou} or Z_{pt}^{demand}, γ_i are household fixed effects, δ_t are year indicators, and ε_{ipt} is the error term, clustered at the province level. This provides the relationship between the pull factors, interacted with SDY flows, and migration. Note that SDY flows are re-scaled by their conditional-on-positive mean so that a one-unit change in the key regressor corresponds to a reform in a sending province that sent the mean amount of SDY to the recipient province.[33]

Table 2 shows the results of these regressions where the dependent variable is whether any member of the household has migrated that year.[34] Column 1 uses *hukou* reforms as a change in the incentive to migrate. At the mean level of SDY connections, a reform that relaxed the constraints for an individual to get an urban *hukou* in a place in which a household may have connections from the SDY program increases the probability of migration by 0.9 percentage points. This effect is significant at the 1% level. Column 2 uses labor demand shocks as the pull factor. A one standard deviation increase in GDP in the manufacturing and construction sectors, in a province at the mean level of SDY connections, increases the probability of migration by 1.8 percentage points, significant at the 5% level. Thus, both *hukou* reforms and labor demand shocks in SDY-sending provinces lead to meaningful changes in the likelihood that rural households in the corresponding SDY-receiving provinces will send members to migrate.

6.1 Excludability of *Hukou* Reforms and Labor Demand Shocks

We examine whether the timing of the *hukou* reforms and labor demand shocks may be capturing other characteristics of the provinces linked through the SDY program rather than changes in the costs and returns to migration. To test this, we estimate the following regressions where t denotes

[33] The mean is 9,874, i.e., roughly 10,000 SDY on average were sent to the provinces in our sample that received any SDY.

[34] The corresponding impacts on whether the entire household migrates (as measured by attrition from the survey) is very small in magnitude and not significantly different from zero. This is not surprising given that less than 1% of households attrite from the survey.

year and p and s denote the provinces:

$$y_{s,t} = \alpha + \beta x_{p,t-1} \times SDY_{s \to p} + \delta_s + \delta_t + \epsilon_{pst} \tag{4}$$

where y is an indicator for the reform or the demand shock, $x_{p,t-1}$ is the lag of the logarithm of GDP per capita or the growth rate of GDP per capita, and $SDY_{s \to p}$ is the historical SDY flows from s to p. We include province- and year-fixed effects. Motivated by our identification assumption, we examine regressions where s refers to provinces that are reforming or experiencing labor demand shocks (and historically sent out SDY) and where p refers to provinces that received SDY in the past. The coefficient, β, tests whether economic conditions in year $t-1$ in provinces p linked to s by SDY flows predict the timing of reforms and labor demand shocks in province s and year t .

The results are presented in columns 1 and 3 of Table 3 where y is an indicator for the *hukou* reform in columns 1 and 2 and the demand shock in columns 3 and 4. The key regressor is the lag of the level or growth rate of GDP per capita in provinces s linked to p via SDY flows. The estimates in column 1 show that the level (Panel A) and growth rate (Panel B) of GDP per capita in province s are not correlated with a *hukou* reform being implemented the following year in SDY receiving provinces, denoted by p. Turning to the labor demand shocks, column 3 examines whether the level of economic activity in provinces linked through the SDY program are correlated with labor demand shocks. The level and growth rate of GDP per capita in province s do not predict the demand shock in the following year in provinces p that are linked to s via SDY flows.[35]

An alternative empirical strategy would be to use labor demand shocks and *hukou* reforms in a household's own province to examine intra-province, rural-to-urban migration patterns. To consider the validity of this strategy, we estimate the following equation:

$$y_{s,t} = \alpha + \beta x_{s,t-1} + \delta_s + \delta_t + \epsilon_{st}. \tag{5}$$

In other words, we examine whether the pull factors in a province follow economic conditions in that province. The results are presented in column 2 and 4. Column 2 suggests that GDP per capita in a province is significantly correlated with the decision to pass a *hukou* reform in that same province. This is perhaps not surprising; areas with more economic activity may have a greater demand for labor in urban areas and this motivates the subsequent passing of *hukou* reforms within the province.

[35] For this reason, we do not instrument the time t demand shock with lagged values, as Card and Lewis (2007) do. However, the first stage estimate when we instrument the time t demand shock with its value at time $t-1$ are very similar; see Appendix Table A.6.

Column 4 shows, not surprisingly, that both the level and growth of GDP per capita in province is predictive of the labor demand shock in that same province in the following year.

In sum, the use of own-province *hukou* reforms or labor demand shocks to identify the impact of access to migration would yield biased estimates because the exclusion restriction would fail. By, instead, using *hukou* reforms and labor demand shocks in other provinces, linked via past SDY flows, to identify the impact of access to migration, we avoid this failure of the exclusion restriction and are able to recover unbiased estimates.

6.2 Robustness Checks on SDY Flows

One concern is that the variation in the SDY flows may be correlated with other variables that drive the results. In this section, we consider whether the results are robust to including controls for distance and trade flows between provinces interacted with the two pull factors (*hukou* reforms and labor demand shocks) in the estimates of equation 3. Finally, we also consider whether there are similarities in the factor endowments of origin and destination provinces of the SDY.

If the cost of moving urban youth to the rural countryside was a key determinant of the rural location to which sent-down youth were assigned, then the greatest flows of SDY would also minimize the distances between provinces.[36] We measure the distances between provinces using the road distance between the provincial capitals (based on Google maps in 2015).[37]

The results are presented in column 2 of Table 4 where the *hukou* reforms are presented in Panel A and the labor demand shocks in Panel B. Using the NFP data from 1995 to 2002, the sample is limited to province-pairs for which there are positive SDY flows.[38] The coefficient on the interaction between the distance between provinces and the *hukou* reforms is positive but not significant. However, the impact of the interaction between *hukou* reforms and the sent-down flows remains positive and significant with the inclusion of the distance control. The interaction between distance and the demand shock is insignificant and the interaction between the demand shock and SDY flows remain significant. Thus, the results provide reassurance that variation in sent-down youth flows is not simply capturing geographic proximity.

As an alternative to distance, trade flows offer a good proxy for proximity between two provinces. We collected data on the volume of goods transported via railways between provinces from the Chinese

[36] It is unlikely that transportation costs were a primary determinant of where people were sent. As shown in Figure A.1, the distances that individuals were moved were often quite large.

[37] We also examined other distance measures: as-the-crow-flies distance and road distance as measured by Poncet (2003). The three measures are highly correlated with correlation coefficients exceeding 97%; the results are very similar.

[38] This is a more conservative test than including values of distances in cases where SDY flows are zero. Column 1 replicates Table 2 with the sub-sample of province-pairs for which there are positive SDY flows.

Transportation Yearbook of 1995.[39] The estimates when we include the interaction between trade flows and the pull factors are presented in column 3 of Table 4. Interestingly, there is a negative and significant impact of trade flows interacted with *hukou* reforms (labor demand shocks) on migration in Panel A (Panel B). More importantly for our analysis, the inclusion of these controls do not alter the coefficients of interest on the pull factors interacted with SDY flows.

Finally, we consider the possibility that the SDY program created similarities between origin and destination provinces in their factor endowments or, alternatively, that SDY were placed in provinces with similar factor endowments as their origins. Subsequent aggregate labor demand shocks in specific sectors may affect economic outcomes, such as migration in both destination and origin provinces in a similar manner.[40] We include controls for the sectoral composition of origin and destination provinces at baseline (1995) and interact those with dummies for each year.

7 Main Results

To examine the impact of changing incentives to migrate on the consumption, income and investment of non-migrating household members, we estimate specifications of the form:

$$y_{ipt} = \alpha + \beta Z_{pt}^{j} + \gamma_i + \delta_t + \epsilon_{ipt} \tag{6}$$

where y_{ipt} is an outcome of interest, as before γ_i and δ_t are household- and year-fixed effects, respectively, and j is either *hukou* or *demand*: Z_{pt}^{hukou} is the reform tally weighted by SDY flows, and Z_{pt}^{demand} is the demand shock weighted by SDY flows. We trim the bottom and top 1% of outliers of the dependent variables. The results are all very similar without trimming the outliers.[41]

For the main results, we focus on the reduced form estimates because there is the potential for effects stemming from *hukou* reforms that operate through the expectation of migrating in the future.[42] For example, a household anticipating the ability to use migration as an ex-post risk smoothing activity in the future (as in Morten 2013) might begin to reduce precautionary buffer stocks or increase risky, high-return investments in advance of actually sending a migrant. There could also be knowledge spillovers from migrants to other households in their community. There may also may be effects of sending a migrant that persist after the migrant has returned, due, e.g. to changes in wealth, credit

[39] We also collected this data for the 1985 yearbook, which is the earliest wave of the data, and the results are essentially identical if we use 1985 data instead of 1995.

[40] However, this seems unlikely given the results in Table 3.

[41] These are available upon request from the authors.

[42] The IV estimates presented in Appendix Tables A.11 to A.16 and discussed in Section 7.5 are similar in sign and significance.

access or information. Our reduced form effects will capture expectation and spillover effects as well as the direct effects of migration; thus, these reduced form estimates capture the effect of increased access to migration.

7.1 Consumption

We begin by considering the impact of changes in the costs of and returns to migration on the level and variability of consumption. Panel A of Table 5 examines effects on the log consumption.[43] Columns 1 and 2 indicate that total consumption increases by 1.3 percent and 1.7 percent in response to increased incentives to migrate via *hukou* reforms and labor demand shocks, respectively. However, the effects are not significant. Food consumption also increases by 1.3 percent, using either source of variation; this is statistically significant at the 5% level for *hukou* reforms (column 3) but not for labor demand shocks (column 4). Non-staple food consumption increases by a similar magnitude, however the effect is not significant at the standard levels (columns 5 and 6).

For risk-averse households, the level of consumption is not a sufficient statistic to describe the effect on welfare; households also care about the variability of consumption. Panel B of Table 5 shows effects on consumption variability, defined as the absolute change relative to the previous year, $|log(c_{it}) - log(c_{i,t-1})|$. The variability of total log consumption falls, but the effect is not significant. However, when we turn to log food consumption (a category of consumption that households may particularly value smoothing), there is a significant reduction in variability associated with access to migration: year-to-year consumption changes are reduced in absolute magnitude by 1 percent and 2.4 percent in response to increased incentives to migrate via *hukou* reforms and labor demand shocks respectively, and these estimates are both significant at the 1% level. Consumption volatility for non-staple food are reduced by 1.6 percent following *hukou* reforms and by 4.4% in response to labor demand shocks. These estimates are also significant at the 1% level.

The ability to migrate ex post and/or receive remittances from migrants may be especially important in response to significant negative shocks, when marginal utility is particularly high. In Panel C of Table 5, we examine whether access to migration reduces the likelihood of large consumption drops defined as drops greater than 15%. Column 1 shows that a large drop in total consumption is 0.7% less likely when households have increased access to migration via *hukou* reforms. The effect for labor demand shocks is similar in magnitude but not significant (column 2). Columns 3 and 4 show

[43] Throughout, the coefficient estimates the effect of one additional reform in a s province that sent the mean amount of SDY to province p or the effect of a one standard deviation increase in construction and manufacturing GDP in a s province that sent the mean amount of SDY to province p; however for ease of exposition we refer to these as the effect of "incentives to migrate" or "opportunities to migrate."

that a large drop in food consumption is 0.8% and 2.2% less likely when households have increased access to migration via *hukou* reforms and labor demand shocks, respectively. These estimates are both significant at 1%. Columns 5 and 6 show that a large drop in non-staple food is 1.3% less likely using *hukou* reforms and 3.6% less likely using labor demand shocks. Again, these are both significant at 1%.

7.2 Income, labor and assets

The positive effects on per-capita consumption levels, and negative effects on consumption variation and risk of large consumption drops are consistent with several possible explanations. Panel A of Table 6 examines effects on the level and variability of income earned by non-migrants. Columns 1 and 2 report the effect on the log of agricultural income. Agricultural income does not decrease; indeed the point estimates of the change in income in response to increased incentives to migrate via *hukou* reforms (labor demand shocks) are 0.12 and 0.05, respectively, though only the latter is significant at the 10% level. Columns 3 and 4 examine the effect on non-agricultural sources of income. The effects are small and not significantly different from zero. The lack of any evidence of a significant drop in income is informative about the marginal return to household assets and labor, a point we return to below.

Panel B of Table 6 examines the effect of migration incentives on income variability, defined as the absolute change relative to the previous year, $|log(y_{it}) - log(y_{i,t-1})|$. The results for increased access to migration via *hukou* reforms show that the variability of agricultural income increases by 1.4 percent (column 1); the variability of non-agricultural income falls by 1.5 percent (column 3). Both effects are significant at the 10% level or lower. Using variation from labor demand shocks indicates a positive but insignificant effect on the variability of agricultural income (column 2), and a significant decrease in the variability of non-agricultural income (column 4). Panel C of Table 6 examines the effect of incentives to migrate on large drops in income (greater than 15%). No significant effects are seen. Overall, the results for the level and variability of income do not follow the effects on consumption; this suggests that the impact of opportunities to migrate on consumption and consumption smoothing do not operate through the changes in the earned income of remaining household members.

We next examine the effect of migration opportunities on the amount of labor used in household activities. Columns 1 and 2 of Table 7 examine the effect on agricultural labor inputs, defined as the number of days that all of the members of the household and hired labor work in agricultural production divided by the number of workers in the household. This is a measure of the intensity

of labor inputs, scaled by the worker population of the remaining household. The magnitude of the estimated effect is small and not significant. Columns 3 and 4 test whether migration has an effect on the number of household laborers, excluding those working as migrants, in levels. There is a small negative, but insignificant, effect associated with access to migration. This result may not be that surprising, given that Table 1 indicated that migrants spend only half of the year away.

Table 8 examines effects of migration opportunities on assets. We examine non-productive assets (such as televisions and bicycles), agricultural assets (such as animals and farm equipment) and non-agricultural assets (such as a cotton gin). All three categories of assets exhibit significant declines. Non-productive assets fall by 3.7% and 5.8% using the *hukou* reforms and labor demand shocks, respectively (both significant at the 1% level). Agricultural assets fall by 4% and 6.6% using the *hukou* reforms and labor demand shocks, respectively (both significant at the 10% level or lower). Non-agricultural assets fall by 2.7% and 4.2% using the *hukou* and labor demand shocks, respectively (both significant at the 5% level or lower).

The significant drop in productive assets, combined with the fact that we do not observe a corresponding fall in income, suggest that the liquidated assets were earning a low or zero return. We do not see an increase in labor use either, which suggests that the fall in assets is not explained by a shift away from capital-intensive activities towards labor-intensive activities. Thus, households may be holding these low-return assets as buffer stocks (Deaton 1991, Anagol, Etang and Karlan forthcoming), which do not contribute significantly to household productivity but could be liquidated in response to a negative shock that could not otherwise be smoothed. Households may then optimally liquidate these assets when they gain access to the consumption smoothing technology provided by access to migration. Alternatively, the fall in assets may be a cause rather than a consequence of migration; migration may be costly and financed by the liquidation of low-yielding assets. We next look for another sign that access to migration allows households to diversify: increased investment in high-risk, high-return activities.

7.3 Investment in risky activities

A corollary of households receiving better access to smoothing strategies via increased opportunities for migration is that the household can move along the risk-return frontier to invest in assets and activities that have a higher expected return, but are riskier. We examine two high-risk activities: growing fruits (orchard fruits, pods and tea), and raising animals. Tea and orchard fruits are typically cash crops (Qian 2008), subject to fluctuations in the market price. Animals can also be expected *a*

priori to be risky, as they are frequently sold at variable market prices and are subject to disease risk (Cai et al. 2015).

We also directly confirm in our NFP data that these activities are high risk; this implies that they must yield high returns to be held in the household portfolio alongside lower-risk investments.[44] Table 9 shows the coefficient of variation (CV) for total agricultural income, non-agricultural income, fruit income and animal income. Panel A shows unconditional CVs and Panel B shows within-household CVs.[45] Unconditionally, fruit and animal income have CVs of 6.2 and 6.7, respectively, compared to 1.3 for total agricultural income and 3.4 for non-agricultural income. Looking within households, the CVs fall because cross-household variation is removed, but the pattern remains the same: fruit income has a CV of 1.9 and animal income a CV of 1.2, while for total agricultural income the figure is 0.64 and for non-agricultural income it is 0.76. Thus, both measures suggest that there is at least twice as much income volatility in the fruit and the animal production categories as compared with total agricultural production and non-agricultural activities.

Table 10 shows that households increase their investment in these high-risk activities. The dependent variable is the logarithm of the number of labor days a household expends in these activities plus one. We observe investment of labor in the form of person-days spent working on each type of activity. Column 1 shows that reductions in the barriers to migration lead to a significant 8% increase in the days worked in animal husbandry. Column 2 shows that an increase in the returns to migration increases the days that households work in animal husbandry by 16% (significant at the 1% level).

Columns 3 and 4 show the corresponding results for fruits. An additional *hukou* reform in an average SDY-linked province corresponds to a 3.8% increase in the time allocated to fruit cultivation, significant at the 1% level. A standard deviation increase in labor demand in an average SDY-linked province corresponds to a 6% increase in the time allocated to fruit cultivation, but this estimate is not significant at the standard levels.

Finally, in Table 11, we examine the effect of migration on income from animal husbandry and fruits. The dependent variable, $log(income + 1)$, captures both intensive and extensive margins. Consistent with the positive effects on days worked in animal husbandry, we see a significant increases in income from animal husbandry of 12% in column 1 and 22% in column 2. These estimates are both significant at the 1% level. The effect on income from fruits in column 3 is 5%, also significant

[44] We cannot directly estimate returns for these activities because we do not observe capital for animals and fruits separately from other household activities.

[45] Whether the cross-sectional or the within-household estimates is more informative for the amount of risk households face depends on whether persistent variations across households are ex ante forecastable. If not, these represent risk and the unconditional CV is informative, while if persistent variations are forecastable, the within-household CV is more informative (see Ligon 2011).

at the 1% level. The impact on fruit income using the demand shock variation is positive but not significant at the standard levels. Overall the results indicate that both investment in and income from high-risk activities increase due to migration opportunities, consistent with households reallocating their portfolios toward these activities in response to the insurance provided by the option of sending migrants.

7.4 Labor market frictions as an alternative explanation

Another possible mechanism through which having a migrant affects the production decision of households is through the loss of a laborer. This may be important if rural labor markets are incomplete and households cannot hire labor to fully replace the lost labor supply of the migrant. However, the fact that we do not see a significant drop in labor used in households with a migrant (Appendix Table A.13) suggests that this mechanism is not first order in our setting. Of course, there is the possibility that the units of labor used (in worker days or in workers) doesn't reflect the fact that the labor that replaces the migrant is different in terms of quality if not quantity. However, the lack of a significant drop in earnings corresponding to migration (Appendix Table A.12) suggests that the labor quality is not much lower.

7.5 Instrumental variables estimates

Estimates of the effects of increased migration opportunities for households that respond directly with an individual migrating may also be of interest. We present instrumental variables estimates of the form:

$$y_{ipt} = \alpha + \beta migrant_{ipt} + \gamma_i + \delta_t + \epsilon_{ipt} \tag{7}$$

where $migrant_{ipt}$, the indicator for sending a migrant, is instrumented with Z_{pt}. For Z_{pt}^{hukou}, this relies on the assumption that all of the effects of the *hukou* reforms in areas with SDY connections operate through the migration of a household member. Similarly for Z_{pt}^{demand}, the assumption of the IV estimates is that demand shocks in areas with SDY linkages operate solely through migration. As discussed above, this assumption will fail if anticipation or spillover effects are present; as such the IV estimates are likely to be upward-biased to the extent they attribute all effects of migration access and returns to household-year observations when a household sends a migrant. The corresponding estimates are presented in Appendix Tables A.11-A.16. As expected, the coefficients are larger in magnitude than the reduced form estimates, but the sign and significance are quite similar. An advantage of the IV estimates is that we can compare the magnitudes of the effects using the two

sources of variation with each other. Interestingly, the estimates are often similar using variation from *hukou* reforms and from labor demand shocks.

8 Discussion and conclusion

Our paper presents a new identification strategy for studying migration in China that exploits variation from multiple sources. We use pre-existing ties between provinces arising from the sent-down youth program interacted with time-varying policies. The first of these is reforms of the *hukou* system. We then compare the long-run changes in barriers to migration associated with *hukou* reforms to short-run labor demand shocks that alter the returns to migration. Interestingly, using variation from our new strategy, based on *hukou* reforms, produces results that are very similar to estimates that exploit the more commonly-used demand shock instrument for migration. One possible explanation is that a *hukou* reform in a province was received as that province being generally more tolerant of migrants, but the type of migration that responds to this change is still largely temporary or seasonal.[46] Perhaps this is not surprising given that most individuals from the poor, rural areas in the NFP survey may be unable to afford the expenditure necessary to obtain an urban *hukou* that would enable permanent migration, at least in the medium-run time frame of our analysis. Another possibility is that migrants in China frequently return home even when they have the option to migrate permanently, causing more permanent changes to access to migration to have similar effects as more transitory changes in migration access.

Our results suggest that, on net, increased access and returns to internal migration are beneficial for rural households. Consumption increases and becomes less variable. The findings rule out a negative wealth effect from having a migrant and rule out the possibility that the total consumption risk a household faces increases as a result of having a migrant. Furthermore, the results suggest that low-yielding assets are liquidated. The proceeds of the liquidation of the assets, potentially combined with net positive transfers from migrants, serve to increase households' cash on hand. The increased cash on hand may fund the observed increase in food consumption and the observed increase in investment in high-risk, high-return assets. An alternative interpretation of the liquidation of low-yielding assets is that they were used to finance the costly migration of a household member.

The finding of an increase in consumption following migration, an event that increases the ability of households to smooth their consumption, echoes the results of Kaboski and Townsend (2011) who

[46] An interesting corollary may be when Chancellor Angela Merkel announced in 2015 that Germany would welcome refugees, leading to a surge of migrants from poor but not war-torn countries into Germany who would not quality for refugee status (Gidda 2016).

study the response of Thai households to increased access to formal credit. Our finding that access to improved consumption smoothing increases investment in risky activities echoes the literature on income smoothing in developing countries (e.g., Rosenzweig and Binswanger 1993, Karlan et al. 2014, Cole et al. 2014, and Emerick et al. 2014, Carter et al. 2015). Moreover, the shock to consumption smoothing that we study here, internal migration, is notable in that there appears to be large demand for rural-to-urban migration, whereas other candidate smoothing policies such as crop or weather insurance, formal savings and credit often appear to suffer from low demand (Cole, Gine and Vickery 2016, Dupas et al 2014, Banerjee, Karlan and Zinman 2015). Nonetheless, previous evidence suggests that temporary, partial-household, internal migration appears to be sub-optimally low (Bryan, Chowdhury and Mobarak 2014). In our particular setting, the sub-optimal level of rural-to-urban migration may reflect government restrictions on mobility in China, including the *hukou* policy. Our results suggest that efforts to promote internal migration are likely to benefit agricultural households.

A *Hukou* Reform Coding

We collect information on *hukou* reforms from several databases, each of which covers local and national laws, rules and regulations in China. We search the following electronic databases that have information about local and national laws, rules and regulations: Peking University's Chinalawinfo, Xihu Law Library (www.law-lib.com), Beijing Zhongtian Nuoshida Technology Company (www.law-star.com) and Zhengbao Online Education Company's database.

We use the following algorithm in each of the four databases to compile our data on *hukou* reforms across provinces and time. We used all combinations of the following two keywords for *hukou* and reform or administration in Chinese and searched the whole body (not just the title) of these records. The words for the *hukou* system used are *hukou* and *huji*. The words for reform or administration are: *gaige* and *guanli*.

We then examine the written description of the laws and regulations carefully to determine whether the record refers to a *hukou* reform that was issued for the first time. We focus on reforms that apply to a wide group of individuals and are likely to be relevant for the rural households in our sample. Thus, we exclude any policies that only allow a very restricted group of individuals to obtain a new *hukou*. If the document refers to a change that only targets PhDs, PhDs from Western universities or owners of very high asset firms, we exclude these from our coding.[47] In some cases, the local government issued documents that discuss general principles of *hukou* reforms without implementing actual reform measures. These are also excluded from our analyses.[48]

B Example: Shanxi

To make the construction of the identifying variation more concrete, we discuss the case of Shanxi, a province in Northwestern China. The SDY flows to Shanxi and *hukou* reforms in the corresponding sending provinces are detailed in Panel A of Table A.4.

Shanxi received SDY from Beijing and Tianjin: 41,300 from Beijing and 7,300 from Tianjin. The reform and SDY interaction for Shanxi, $Z_{Shanxi,t}$ will equal 0 until 1998, when it will take the value 41,300, representing the SDY flows received from the Beijing, which implemented a reform in 1998.

[47] For example, in 2002, the city of Beijing issued a policy document, titled "A notice on four measures to implement rules on opening further to domestic and further developing Beijing economy", that allows senior managers of large state-owned business groups and firm owners who invested at least 30 million RMB in Beijing to apply for Beijing *hukou*.

[48] For example, Sichuan provincial government issued a document in 1998 called "A note on solving several important problems in the Hukou system." The document indicates that Sichuan provincial government was thinking of doing some *hukou* policy experiment in a few cities. However, the document doesn't specify which places and when these experiments would be implemented.

No additional reforms are implemented in provinces that sent SDY to Shanxi until 2002, so $Z_{Shanxi,t}$ remains at 41,300 until 2002. In that year Beijing implements another reform, so $Z_{Shanxi,t}$ increases to 82,600 $(41,300 \times 2)$.

Tianjin did not implement any *hukou* reforms over the 1992 to 2002 time period, so the SDY flows from Tianjin to Shanxi do not enter into the construction of our instruments. Any time-invariant effects on Shanxi due to its historical ties with Tianjin will be absorbed into the fixed effect for households in Shanxi.

C Origin-Destination Flows

C.1 Origin-Destination SDY Links and Migration

We analyze whether SDY linkages between provinces from s to p predict subsequent migration from p to s using two separate data sets that have information about the origin and destination provinces of migrants. One is the 2002 China Household Income Project (CHIP). The advantage of this wave of the CHIP data is that it deliberately targets rural-to-urban migrants. Of the 5327 households surveyed, 1674 have individuals who have moved across provinces. The survey was conducted in 12 provinces, and interprovincial migrants are from 29 different origin provinces. The second data set we use is the NFP over the waves 2010 to 2012.[49] Unlike the main NFP data set used in this analysis that spans 1995 to 2002, the three years from 2010 to 2012 include information on the destination province of the migrant.[50]

We estimate the following equation:

$$Y_{p \to s} = \beta_0 + \beta_1 X_{s \to p} + \delta_s + \gamma_p + \epsilon_{sp} \tag{8}$$

where each observation is a province s-province p pair such that $s \neq p$.[51] The dependent variable, $Y_{p \to s}$, is a measure of the migration flows from province p to province s; this is aggregated to the

[49] We were able to use a representative sub-sample of 45,960 person-year observations to calculate aggregate migration flows. We see 4192 cross-province migrants (and their corresponding origins and destinations) and 4993 intra-province migrants.

[50] The NFP survey is quite different in the 2010-2012 waves as compared to 1995-2002. The later waves do not include all of the variables used in the main analysis and for topics that do overlap, the phrasing of the question can be quite different. Moreover, the full microdata are not readily available to outside researchers at this time. For these reasons, we do not use these waves in our main analysis.

[51] We focus on *inter-provincial* SDY flows for two reasons. One is data: to our knowledge, systematic records of intra-provincial SDY flows were not centrally maintained. The second is that, in order to interact intra-provincial SDY flows with time-varying shocks, we would have to maintain the assumption of exogeneity of the timing of own-province *hukou* reforms and labor demand shocks. As shown in Table 3 and discussed below, the exclusion restriction holds for reforms and shocks in provinces linked by inter-provincial SDY flows but not for own-province reforms and shocks.

province-pair level from the household data sets as the logarithm of one plus the total number of migrants from p to s. The key regressor is $X_{s\to p}$, a measure of the historical aggregate flows of sent-down youth from province s to province p based on data published by the Sent-down Youth Office of the State Council of China (1983). $X_{s\to p}$ is the logarithm of the total number of youths sent from s to p (plus one). The regressions also include fixed effects for origin and destination provinces, which control for the general attractiveness of a destination or the general migration propensity of individuals from an origin. The standard errors are clustered two-ways at both the origin province and at the destination province to allow for arbitrary correlations of the error term within both origin and destination provinces.

The results are displayed in Appendix Table A.8. Column 1 suggests that each additional 10,000 people that the government sent down from s to p in the 1960s and 1970s increases migration flows in the reverse direction by 11% in 2002 as measured in the CHIP data.[52] The corresponding estimate in the NFP 2010-2012 data shown in column 2 is a 5.7% increase. Both estimates are significant at the 5% level or higher. These results are supportive of the idea that the program of sent-down youth created lasting inter-province linkages.

C.2 Origin-Destination Variation and Pull Factors

In addition to testing whether SDY flows from s to p predict subsequent migration from p to s in the previous section, we can use the 2010-2012 NFP data, which contains information on migrants' origin and destination, to test whether the interaction of SDY with the two pull factors in province s led to more migration from p to s.

Over a sample where each observation is a origin-destination-year, we estimate:

$$flows_{p\to s,t} = \beta_0 + \beta_1 M^j_{st} + \beta_2 M^j_{st} \times SDY_{s\to p} + \delta_{sp} + \delta_t + \epsilon_{spt} \tag{9}$$

where $j = \{reform, demand\}$, $flows_{p\to s,t}$ is the logarithm of the total number of migrants arriving in province s from p in year t. M^{reform}_{st} equals $\sum_{u\leq t} d_{su}$ and is the accumulated number of reforms that occurred between the years 2010 to 2012 in province s by year t. M^{demand}_{st} is the level of GDP in manufacturing and construction in province s in year t.[53] We also include an interaction between M^j_{st} and $SDY_{s\to p}$, the historical SDY flows from s to p. The regression also includes origin-destination fixed effects and year fixed effects. We cluster the standard errors at the origin-destination province

[52] The SDY flows are re-scaled by their conditional-on-positive mean where the mean is roughly 10,000 people.

[53] We summarize the reforms occurring between 2010 and 2012 in Appendix Table A.9.

pair level.

The results are presented in Appendix Table A.10 where the dependent variable is the logarithm of the number of migrants arriving from province p to province s in year t. Columns 1 and 2 show that, while *hukou* reforms increase in-migration from provinces without historical SDY ties, each additional 10,000 SDY who were sent from s to p increase the response by a further extent, statistically significant at the 1% level. That is, the response to *hukou* reforms is significantly greater for migrants coming from provinces with historical ties to the reforming province. Columns 3 and 4 replicate this analysis for the labor demand shocks, however the effects are not precisely estimated, perhaps reflecting the financial crisis of 2008, which increased local unemployment and hence dampened the extent to which demand in manufacturing and construction translated into demand for migrant workers.

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Table 1: Summary Statistics

	Mean	Std Dev	N
Migrant (0/1)	0.162	0.368	14014
Migration (Days)	29.78	79.24	14014
Migration (Days, not including zeros)	184.0	102.1	2268
Year	1995.6	1.691	14016
Total Consumption (per person)	508.4	428.2	13794
Food Consumption (per person)	262.4	150.9	13687
Non-Staple Food Consumption (per person)	145.8	131.4	13704
Agricultural Income (per worker)	2846.5	2328.9	11459
Non-Agricultural Income (per worker)	3345.5	5160.8	11461
Agricultural Labor Inputs (per worker)	166.9	97.91	11441
Household Laborers	2.420	0.978	11322
Non-Productive Assets (per worker)	1079.8	1532.9	11497
Agricultural Assets (per worker)	470.5	689.2	11428
Non-Agricultural Assets (per worker)	98.42	1059.3	11324
Positive Days on Fruits (0/1)	0.220	0.414	14015
Days on Fruits (per worker, not including zeros)	29.09	44.65	2820
Days on Fruits (per worker)	5.579	17.52	11462
Income from Fruits (per worker)	120.1	494.2	11434
Positive Days on Animal Husbandry (0/1)	0.710	0.454	14015
Days on Animal Husbandry (per worker, not including zeros)	55.90	45.08	9051
Days on Animal Husbandry (per worker)	42.08	40.61	11470
Income from Animal Husbandry (per worker)	699.3	970.2	11435
High Education (middle school degree or higher)	0.475	0.499	14012

Notes: The table presents summary statistics of the NFP data where each observation refers to the first period that a household appears in the data.

Table 2: The Impact of Pull Factors Interacted with SDY Flows on Migration

	(1)	(2)
Reform Tally × SDY Flows	0.009***	
	(0.003)	
Demand Shock × SDY Flows		0.018**
		(0.007)
N	91151	91150
F-statistic on instruments	11.63887	7.124772
p-value	.0031107	.0156397

Notes: The dependent variable is a binary measure of whether the household has a migrant. The regressions include household fixed effects, year indicators and a constant term. The variable $ReformTally$ for s in t is the accumulated number of reforms in provinces that sent SDY to s by year t; see Section 5 for details. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table 3: Differences in the Level and Growth Rate of GDP per Capita

	Hukou Reform		Demand Shocks	
	SDY	Own	SDY	Own
	(1)	(2)	(3)	(4)
Panel A: Level				
Log GDP per Capita X SDY Flows	0.006		0.001	
	[0.017]		[0.001]	
Log GDP per Capita		0.777*		5.234**
		[0.344]		[0.635]
N	75	112	140	143
Panel B: Growth Rate				
Growth Rate X SDY Flows	-0.015		0.008	
	[0.036]		[0.008]	
Growth Rate		-0.557		-3.803**
		[0.627]		[1.172]
N	75	112	140	143

Notes: The data for log GDP per capita is from the National Bureau of Statistics. The regressions include year fixed effects, province fixed effects and a constant term. In columns 1 and 2, the dependent variable is an indicator for a reform being implemented in the following year; the sample is restricted to pre-reform observations. In columns 3 and 4, the dependent variable is the demand shock measure in the following year.

Table 4: Robustness Checks: The Impact of the Pull Factors Interacted with SDY Flows with Controls

	(1)	(2)	(3)	(4)
Panel A: Hukou Reforms				
Reform Tally × SDY Flows	0.014***	0.012***	0.013***	0.012**
	(0.002)	(0.003)	(0.002)	(0.004)
Reform Tally × Distance		0.001		
		(0.001)		
Reform Tally × Trade Flows			-0.033**	
			(0.013)	
Time-Varying Sector Effects	No	No	No	Yes
N	59991	59991	59991	59991
Panel B: Demand Shocks				
Demand Shock × SDY Flows	0.027***	0.019**	0.027***	0.030***
	(0.006)	(0.008)	(0.005)	(0.007)
Demand Shock × Distance		0.000		
		(0.000)		
Demand Shock × Trade Flows			-0.000**	
			(0.000)	
Time-Varying Sector Effects	No	No	No	Yes
N	59990	59990	59990	59990

Notes: The dependent variable is a binary measure of whether the household has a migrant. The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. The time-varying sector effects allow for time-varying effects of initial sectoral composition by interacting indicators for activity in three sectors (agriculture, production (including manufacturing and construction), service) in 1995 with indicators for each year. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 5: Estimates of Migration Incentives on the Level and Change in Consumption

	Log Total Consumption		Log Food Consumption		Log Non-Staple Food	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Level of Consumption						
Reform Tally × SDY Flows	0.013		0.013**		0.014	
	(0.008)		(0.006)		(0.009)	
Demand Shock × SDY Flows		0.017		0.013		0.006
		(0.019)		(0.016)		(0.021)
N	87458	87455	87496	87493	87497	87494
Panel B: Variability of Consumption (Abs. Value First Differences)						
Reform Tally × SDY Flows	-0.004		-0.010***		-0.016***	
	(0.004)		(0.003)		(0.003)	
Demand Shock × SDY Flows		-0.005		-0.024***		-0.044***
		(0.012)		(0.005)		(0.005)
N	74221	74221	74218	74218	74214	74214
Panel C: Variability of Consumption (Indicator for Drops > 15%)						
Reform Tally × SDY Flows	-0.007***		-0.008***		-0.013***	
	(0.003)		(0.002)		(0.003)	
Demand Shock × SDY Flows		-0.012		-0.022***		-0.036***
		(0.008)		(0.003)		(0.008)
N	75910	75909	75910	75909	75910	75909

Notes: The dependent variables are per capita measures of consumption. The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table 6: Estimates of Migration Incentives on the Level and Change in Income

	Agricultural Income		Non-Agricultural Income	
	(1)	(2)	(3)	(4)
Panel A: Level of Income				
Reform Tally × SDY Flows	0.012		0.012	
	(0.012)		(0.013)	
Demand Shock × SDY Flows		0.050*		-0.029
		(0.027)		(0.024)
N	72524	72523	72457	72457
Panel B: Variability of Income (Abs Value First Differences)				
Reform Tally × SDY Flows	0.014*		-0.015**	
	(0.008)		(0.008)	
Demand Shock × SDY Flows		0.001		-0.032*
		(0.015)		(0.017)
N	60086	60086	59988	59988
Panel C: Variability of Income (Indicator for Drops > 15%)				
Reform Tally × SDY Flows	-0.002		-0.003	
	(0.004)		(0.004)	
Demand Shock × SDY Flows		-0.010		-0.007
		(0.009)		(0.009)
N	75910	75909	75910	75909

Notes: The dependent variables are the log of per capita measures of income. The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table 7: Estimates of Migration Incentives on Labor

	Log Ag Labor Inputs		Number of HH Laborers	
	(1)	(2)	(3)	(4)
Reform Tally × SDY Flows	0.001		-0.003	
	(0.008)		(0.008)	
Demand Shock × SDY Flows		0.019		-0.016
		(0.018)		(0.024)
N	72528	72527	72614	72612

Notes: The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table 8: Estimates of Migration Incentives on Assets

	Non-Productive Assets		Agricultural Assets		Non-Agricultural Assets	
	(1)	(2)	(3)	(4)	(5)	(6)
Reform Tally × SDY Flows	-0.037***		-0.040***		-0.027***	
	(0.007)		(0.014)		(0.009)	
Demand Shock × SDY Flows		-0.058***		-0.066*		-0.042**
		(0.012)		(0.035)		(0.021)
N	72570	72567	72739	72736	34401	34399

Notes: The dependent variable is the log of assets. The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table 9: Coefficient of Variation by Income Categories

	Agricultural Income	Non-Agricultural Income	Fruit Income	Animal Income
	(1)	(2)	(3)	(4)
Panel A: Unconditional CV				
Coefficient of Variation	1.335	3.415	6.189	6.723
N	91193	91193	91193	91193
Panel B: Within Household CV				
Coefficient of Variation	0.641	0.758	1.855	1.213
N	12163	12207	5341	11144

Notes: The coefficient of variation is the standard deviation divided by the mean. In Panel A, it is calculated using the unconditional mean and standard deviation across all observations in the data. In Panel B, it is calculated using the mean and standard deviation within households for households that have at least two years of positive income in the category.

Table 10: Estimates of Migration Incentives on Labor in High-Risk Activities

	Days on Animal Husbandry		Days on Fruit	
	(1)	(2)	(3)	(4)
Reform Tally × SDY Flows	0.080***		0.038***	
	(0.015)		(0.013)	
Demand Shock × SDY Flows		0.161***		0.060
		(0.035)		(0.038)
N	72395	72393	71961	71959

Notes: The dependent variable is the logarithm of the number of days in that activity plus one. The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table 11: Estimates of Migration Incentives on Income from High-Risk Activities

	Animal Husbandry Income		Fruit Income	
	(1)	(2)	(3)	(4)
Reform Tally × SDY Flows	0.117***		0.049***	
	(0.026)		(0.019)	
Demand Shock × SDY Flows		0.219***		0.068
		(0.055)		(0.052)
N	72309	72307	71914	71912

Notes: The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Figure A.1: Direction of Sent-Down Youth Flows

Source of Map: Bonnin 2013

Table A.1: Summary Statistics by Migration Status

	Ever Migrate Household			Never Migrate Household			
	Mean	Std Dev	N	Mean	Std Dev	N	p-values
Year	1,995.384	1.188	7,304	1,995.916	2.070	6,712	0.000
Total Consumption (per person)	497.229	415.942	7,211	520.761	441.066	6,579	0.001
Food Consumption (per person)	261.415	148.833	7,180	263.563	153.210	6,503	0.406
Non-Staple Food Consumption (per person)	142.734	129.940	7,184	149.246	132.884	6,516	0.004
Agricultural Income (per worker)	2,779.052	2,259.582	6,252	2,928.420	2,407.705	5,203	0.001
Non-Agricultural Income (per worker)	3,095.183	4,655.876	6,254	3,641.645	5,686.787	5,203	0.000
Agricultural Labor Inputs (per worker)	170.589	94.945	6,234	162.567	101.187	5,203	0.000
Household Laborers	2.485	1.004	6,174	2.344	0.941	5,144	0.000
Non-Productive Assets (per worker)	944.126	1,401.349	6,277	1,242.610	1,663.276	5,216	0.000
Agricultural Assets (per worker)	430.003	634.392	6,240	519.604	747.259	5,184	0.000
Non-Agricultural Assets (per worker)	49.410	921.891	6,204	157.608	1,202.841	5,116	0.000
Positive Days on Fruits (0/1)	0.240	0.427	7,301	0.198	0.398	6,710	0.000
Days on Fruits (per worker, not including zeros)	24.625	36.165	1,602	34.964	53.305	1,216	0.000
Days on Fruits (per worker)	5.445	16.924	6,267	5.735	18.219	5,191	0.377
Income from Fruits (per worker)	111.158	458.179	6,254	130.950	534.537	5,176	0.033
Positive Days on Animal Husbandry (0/1)	0.772	0.420	7,301	0.643	0.479	6,710	0.000
Days on Animal Husbandry (per worker, not including zeros)	55.583	44.226	5,234	56.319	46.213	3,813	0.443
Days on Animal Husbandry (per worker)	44.566	40.005	6,252	39.096	41.108	5,214	0.000
Income from Animal Husbandry (per worker)	741.221	982.266	6,244	648.992	953.409	5,187	0.000
High Education (middle school degree or higher)	0.467	0.499	7,298	0.484	0.500	6,710	0.041

Notes: The table presents summary statistics of the NFP data where each observation refers to the first period that a household appears in the data.

Table A.2: Interprovince Sent-Down Flows

Sent down to:	Heilongjiang	Liaoning	Ningxia	Zhejiang	Hebei	Shanxi	Yunnan	Guizhou	Gansu	Xinjiang	Qinghai
Sent from:											
Beijing	10.4	0.11	0.45	0	1.4	4.13	0.84	0	0	0	0
Tianjin	6.7	0.29	0.2	0	11.87	0.73	0	0	1.19	0.91	0
Hebei	0	0	0	0	0	0	0	0	0	0	0
Shanghai	16.98	0.06	0	3.2	0	0	5.56	1.06	0	10	0
Jiangsu	0	0	0	0	0	0	0	0	0	1.7	0
Zhejiang	5.82	0	0.18	0	0	0	0	0	0	0.49	0
Shandong	0	0	0	0	0	0	0	0	0.72	0	0.74
Hubei	0	0	0	0	0	0	0	0	0	0.8	0
Sichuan	0.4	0	0	0	0	0	4.1	0	0	0	0

Note: The table presents the total number of educated youth sent down from one province to another. The units are 10,000 people.

Table A.3: City-Level *Hukou* Reforms: 1993-2002

Province	Reform Year	Description	Document Name	Issue Date
Beijing	1998	A migrant can get hukou in pilot satellite cities of Beijing if she buys an apartment and has a stable job.	JingZhengBanFa[1997] No.74	December 31, 1997
	2002	A migrant can get hukou in 14 satellite cities and 33 towns if she has* an apartment and a stable job.	JingZhengFa[2002] No.25	September 23, 2002
Zhejiang	1998	A migrant can get hukou in Hangzhou City, the capital of Zhejiang Province, if she buys an apartment and has a stable job Hangzhou.	HangZhengBan[1998] No.31	September 20, 1998
	2000	A migrant can get hukou in most cities in Zhejiang province (entry conditions are not specified in great detail).	ZheZheng[2000] No.7	September 1, 2000
	2002	A migrant should get hukou in most cities if she has* an apartment and also a stable job.	ZheZhengBanFa[2002] No. 12	March 29, 2002
Shanghai	1994	A migrant can get a temporary Shanghai hukou if she has* an apartment and a stable job.	Shanghai LanYin hukou Guanli Zanxing Guiding	February 1, 1994
	1998	A revision of the 1994 law by decreasing the entry bar further.† *	HuFuFa[1998] No.47	October 25, 1998
	2002	A migrant can apply for <Shanghai Resident Permit> if he has special skills, and this Permit allows the holder to enjoy most benefits a Shanghai citizen has.	HuFuFa[2002] No. 122	April 30, 2002
Jiangsu	1995	A migrant can get a temporary city hukou if she has** an apartment in Nanjing City.	NingZhengBanFa[1995] No. 79	June 14, 1995
	2001	A migrant can get a city hukou if she has* an apartment or a stable job.	XuZhengFa[2001] No. 38	April 30, 2001
	2002	A migrant can get a city hukou if she has* an apartment or a stable job in most cities in Jiangsu province.	SuZhengFa[2002] No. 142	November 22, 2002
Shandong	1993	A migrant can get hukou in Yingkou City if she buys an apartment.	Yingkou Lanyin hukou Guanli Zanxing Guiding	December 1993
	2000	A migrant can get a city hukou in Shangdong if she has* an apartment in most small and medium size cities.	LuZhengFa[2000] No.7	January 14, 2000
	2001	A migrant can get a city hukou in Shangdong Province if she has* an apartment and a stable job. This is a further reform with respect to the 2000 reform.	LuZhengFa[2001] No.107	October 10, 2001

*Renting or buying an apartment are allowed.

** Employer-provided dormitories are included.

†In the 1994 reform, if one wants to buy an apartment to obtain a Shanghai hukou, she has to buy at least 100 square meters; in 1998 this number was decreased to 70 square meters for Puxi and 65 square meters for Pudong. Also in 1998 Puxi was redefined to include several more remote areas: Jiading, Minhang, Baoshan, Jinshan, Songjiang, Nanhui, Fengxian, Qingpu and Chongming.

Table A.4: SDY flows and *Hukou* reforms affecting Shanxi

Panel A: Provinces sending SDY to Shanxi and reform dates		
Sending province	SDY to Shanxi	Hukou reform dates
Beijing	41,300	1998, 2002
Tianjin	7,300	None
Panel B: Measure of Access to Migration for Shanxi		
Year	$Z_{Shanxi,t}$	Source
1995	0	-
1996	0	-
1997	0	-
1998	41,300	Beijing
1999	41,300	-
2000	41,300	-
2001	41,300	-
2002	82,600	Beijing

Table A.5: Effect of Hukou Reforms and Labor Demand Shocks on Procurement/Market Prices

	(1)	(2)
Hukou Reform X SDY Flows	0.008	
	(0.009)	
Demand Shock X SDY Flows		-0.001
		(0.023)
N	767	767

Notes: Each observation is a province-crop-year. The crops are: grain, oil seed, cotton, sugar, meat, silk, fruit, dry fruit, dry vegetables and condiments. The dependent variable is the ratio of procurement price to market price. The data cover the years 1995 to 2000. The regressions include year indicators, crop indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table A.6: The Impact of Labor Demand Shocks (Instrumented with Lagged Values) Interacted with SDY Flows

	OLS	IV
	(1)	(2)
Demand Shock × Flows	0.032***	0.032**
	(0.012)	(0.012)
F-statistic on instruments	7.660448	7.049364
p-value	.0056444	.0161154

Notes: The dependent variable is a binary measure of whether the household has a migrant. In column 2, the labor demand shock at t is instrumented with its value at $t-1$. The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table A.7: The Impact of Pull Factors Interacted with SDY Flows as a Share of Population on Migration

	(1)	(2)
Reform Tally × SDY/N	0.015**	
	(0.007)	
Demand Shock × SDY/N		0.025*
		(0.014)
N	91180	91179

Notes: The dependent variable is a binary measure of whether the household has a migrant. The regressions include household fixed effects, year indicators and a constant term. The variable $ReformTally$ for s in t is the accumulated number of reforms in provinces that sent SDY to s by year t; see Section 5 for details. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table A.8: Historical Sent-Down Flows and Subsequent Inter-Province Migration

	CHIP	NFP
	2002	2010-2012
	(1)	(2)
Sent Down Flows	0.111**	0.057***
	(0.027)	(0.007)
N	234	300
LHS Variable Mean	1.292	0.402

Notes: The dependent variable is inter-province migration flows. Regressions also include destination province fixed effects and origin province fixed effects. The dependent variable is the log of inter-province migration flows plus 1. Robust standard errors clustered two ways by origin province and by destination province in parentheses. *, **, *** denote significance at the 10%, 5% and 1% levels, respectively.

Table A.9: *Hukou* Reform in China: 2010-2012

Province	Reform Year	Description of Hukou Reform	Document Name	Issue Date
Hebei	2010	If a migrant has a hukou in Hebei Province, she can get a urban hukou if she lives in that city for more than 6 months.	JiZheng (2010) No.124	December 1, 2010
Shanghai	2010	A migrant can get a Shanghai hukou if she has a special talent, including a PhD degree or expertise in some fields.	HuFuFa (2010) No.28	August 6, 2010
	2011	Relaxation of some restrictions on the hukou of the spouses of migrants and clarifying that the talent requirement includes the special skills and agricultural experts.	Hu RenSheLiFa (2011) No. 2	September 8, 2011
Jiangsu	2010	There were a series of hukou reforms in different cities in Jiangsu Province, including Suzhou City, Taizhou City, and Changzhou City. A migrant can get the city hukou if she buys (in Suzhou and Changzhou) or rents an apartment (in Taizhou).	SuFa (2010) No. 301	November 13, 2010
Shandong	2011	A migrant can get a city hukou in Dezhou if she rents an apartment and has a job.	LuZhengBanfa (2011) No. 40	August 23, 2011
	2012	A migrant can get a city hukou in several cities (Rizhao, Zibo, Liaocheng, Bingzhou) in Shangdong Province if she rents an apartment and has a job.	RiGongTongZi (2012) No. 194	November 20, 2012

Table A.10: Migration Pull Factors and Inter-Province Migration Flows

	(1)	(2)	(3)	(4)
Reform Tally	1.983**	1.781*		
	[0.983]	[0.951]		
Reform Tally × SDY Flows		3.789***		
		[0.951]		
Demand Shock			-0.012	0.001
			[0.105]	[0.107]
Demand Shock × SDY Flows				0.623
				[0.733]
N	291	144	291	144

Notes: The dependent variable is log inter-province migration flows. Each observation is an origin-destination-year. The data set used is the NFP 2010-2012. The regressions include year indicators and a constant term. The standard errors are clustered at the origin-destination province pair level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table A.11: IV Estimates of Migration on the Level and Change in Consumption

	Log Total Consumption		Log Food Consumption		Log Non-Staple Food	
	IV: Hukou	*Demand*	*Hukou*	*Demand*	*Hukou*	*Demand*
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Level of Consumption						
Migrant	1.362*	0.919	1.355**	0.749	1.440	0.354
	(0.818)	(0.937)	(0.585)	(0.764)	(0.955)	(1.125)
N	87453	87453	87491	87491	87492	87492
Panel B: Variability of Consumption (First Differences)						
Migrant	-0.691	-0.380	-1.458**	-1.741*	-2.242**	-2.986**
	(0.553)	(0.760)	(0.717)	(0.947)	(1.003)	(1.522)
N	74221	74221	74218	74218	74214	74214
Panel C: Variability of Consumption (Indicator for Drops > 15%)						
Migrant	-1.149***	-0.865*	-1.366**	-1.556*	-2.031**	-2.596*
	(0.405)	(0.515)	(0.631)	(0.794)	(1.014)	(1.399)
N	75909	75909	75909	75909	75909	75909

Notes: The dependent variables are per capita measures of consumption. The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table A.12: IV Estimates of Migration on the Level and Change in Income

	Agricultural Income		Non-Agricultural Income	
	IV: Hukou	*Demand*	*Hukou*	*Demand*
	(1)	(2)	(3)	(4)
Panel A: Level of Income				
Migrant	1.128	2.621*	1.124	-1.517
	(1.087)	(1.436)	(1.362)	(1.397)
N	72523	72522	72456	72456
Panel B: Variability of Income (First Differences)				
Migrant	2.000	0.104	-2.063*	-2.227
	(1.887)	(1.160)	(1.092)	(1.536)
N	60086	60086	59988	59988
Panel C: Variability of Income (Indicator for Drops > 15%)				
Migrant	-0.309	-0.738	-0.515	-0.487
	(0.635)	(0.749)	(0.645)	(0.682)
N	75909	75909	75909	75909

Notes: The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table A.13: IV Estimates of Migration on Labor

	Log Ag Labor Inputs		Number of HH Laborers	
	IV: Hukou	*Demand*	*Hukou*	*Demand*
	(1)	(2)	(3)	(4)
Migrant	0.127	1.019	-0.298	-0.854
	(0.779)	(0.979)	(0.831)	(1.478)
N	72527	72526	72612	72611

Notes: The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table A.14: IV Estimates of Migration on Assets

	Non-Productive Assets		Agricultural Assets		Non-Agricultural Assets	
	IV: Hukou	*Demand*	*Hukou*	*Demand*	*Hukou*	*Demand*
	(1)	(2)	(3)	(4)	(5)	(6)
Migrant	-3.773***	-3.284**	-3.772**	-3.466	-2.544***	-1.788**
	(1.376)	(1.391)	(1.825)	(2.296)	(0.912)	(0.814)
N	72567	72566	72736	72735	34400	34399

Notes: The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table A.15: IV Estimates of Migration on Labor in High-Risk Activities

	Days on Animal Husbandry		Days on Fruit	
	IV: Hukou	*Demand*	*Hukou*	*Demand*
	(1)	(2)	(3)	(4)
Migrant	7.610***	8.322***	3.800*	3.286
	(1.959)	(3.085)	(2.157)	(3.165)
N	72393	72392	71959	71958

Notes: The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.

Table A.16: IV Estimates of Migration on Income from High-Risk Activities

	Animal Husbandry Income		Fruit Income	
	IV: Hukou	*Demand*	*Hukou*	*Demand*
	(1)	(2)	(3)	(4)
Migrant	11.139***	11.355**	4.951*	3.705
	(3.838)	(4.773)	(2.911)	(3.892)
N	72307	72306	71912	71911

Notes: The regressions include household fixed effects, year indicators and a constant term. The standard errors are clustered at the province level. *, **, *** denotes significance at the 10%, 5% and 1% levels, respectively.