Labor Migration, Capital Accumulation, and the Structure of Rural Labor Markets*

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Abstract

This paper studies how rural labor markets in Malawi changed in the three decades following exogenous shocks in the 1960s and 70s to the ability to migrate to work on South African gold mines. We assemble four waves of Census data and newly digitized archival data on remittances at sub-national level to track how employment patterns changed across districts receiving different inflows of migrant earnings. Holding constant the number of labor migrants from each district, we show that larger capital inflows led to employment diversifying away from agriculture and into the more capital-intensive non-farm service sector. Furthermore, districts with more migrant capital accumulated physical capital and saved at higher rates over the long run. This evidence suggests that capital accumulated through labor migration can trigger structural change in sending community labor markets. [134 words]

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1 Introduction

Agricultural jobs currently represent the major source of employment in low income countries, with between 22% and 50% of workers engaged in this sector (FAO, 2010). To date, no country has experienced significant increases in incomes without a structural shift out of agriculture into either employment in manufacturing or services. A central question in development therefore is: how do these transitions away from agriculture occur? What do workers in poor, rural areas need in order to shift their time out of low productivity farming and into higher productivity and more diverse types of work in the manufacturing and service sectors?

In this paper, we ask whether international labor migration, and the capital accumulation it allows, can facilitate structural transformation in migrant origin communities. Specifically, we investigate whether the return of migrant capital to agrarian economies has persistent effects on the types of work people do. We go beyond short and medium run effects of migration on individual migrant households and estimate long run general equilibrium effects of specific labor migration episodes and accumulated capital on local labor markets.

The literature has identified three theoretical channels through which more capital in a rural agrarian economy could trigger structural transformation in the labor market. First, an increasing supply of capital may relax credit constraints in agriculture, enabling farmers to invest in farm capital and scale up production. Once minimum food production targets are met, excess labor is released to ("pushed into") the non-farm sector. Second, additional capital may relax credit constraints in the non-farm sector, allowing entrepreneurs to enter or expand in this sector by investing in non-farm capital. With more capital available to this sector, the marginal product of labor in service sector jobs rises, "pulling" labor out of farming.[1] Third, more money in the hands of consumers with non-homothetic preferences may lead to demand shocks that cause the non-farm goods and services sector to expand more than the farm sector. Changing relative prices in response to increasing incomes changes the relative profitability of farm and non-farm work, pulling labor away from farming and into the non-farm sector.[2] Underlying each of these channels is the idea that there is insufficient capital to break out of a poverty trap. With sufficient capital injections to release credit constraints in the farm or non-farm sectors, or increase local demand, a one-time increase

[1]These credit constraint channels harken back to an old idea in development (Lewis, 1954; Gollin, 2014): that a lack of capital (savings) keeps workers trapped in low productivity farming, and that more savings is a necessary condition for moving workers into higher productivity non-farm work. Credit constraints in the non-farm sector are also emphasized in the macro literature on financial intermediation in development, see Buera Kaboski and Shin (2013) for a review.

[2]These demand externalities are a key mechanism highlighted in "big push" models of development, for example, Rosenstein-Rodan (1943); Murphy, Schleifer, and Vishny (1989).

in capital can increase savings and investment at the local level, thereby having persistent impacts on the structure of rural labor markets.

The empirical evidence on the long run persistence of capital injections is limited.[3] And, while the migration literature has a long history of trying to understand and estimate the impact of migrant money coming back into migrant households[4], there is little empirical support for (or against) any of the three channels for migrant capital to affect the structure of sending economies, especially over the long run. Until now, lack of appropriate data on migration and money flows, limited exogenous variation in these flows, small sample sizes, and poor data on output and employment shares over a long enough period of time have made it challenging to empirically test the idea that capital accumulated through migration can change the structure of an economy, as Clemens and McKenzie (2014) point out.

We address these challenges by studying the historical context of rural Malawi and the way that local labor markets for female and male labor changed in the three decades after large, plausibly exogenous shocks to the option to undertake temporary international migration. In Malawi's long history of sending miners to work on South African gold mines, two events in the 1960s and 1970s first expanded, and then shut down, the ability to take up these jobs.[5] In the years bracketed by these events, Malawi experienced a 200% increase in migration and received over 53 million USD from compulsory migrant remittances.[6] The treatment we analyze is the effects of these capital inflows received by districts between 1966 and 1975. We use migration shocks that differ across space within Malawi to test for the joint effect of all three channels of influence of migrant capital on the structure of rural labor markets over the long run.

To do this, we digitized archival data on remittances and matched it with four waves of post-shock and several waves of pre-shock Census data. This unique dataset allows us to track changes in local labor market outcomes, like the share of workers in different sectors and the diversity of occupations, over a long period of time at the local labor market level. By piecing together Census data over time, we control for district and decade fixed effects and a host of

[3]Although see Gollin, Jedwab and Vollrath (2016) as a recent example of the effects of revenue from resource exports on urbanization and the structure of employment in cities around the world.

[4]For example, Dustmann and Kirchkamp (2002) and (Woodruff and Zeneto, 2007). (Yang, 2006) is one of the few examples where an exogenous shock to migrant earnings is used to causally estimate the impacts on investments in business-related capital (property, and vehicles) in migrant households.

[5]The first event in 1967 entailed removing all recruiting quotas. The second was the banning of migration in response to a plane crash that killed returning miners in 1975. We discuss these historical events in some detail in Dinkelman and Mariotti (2016). Unexpected bans on migration, initiated either by sending or receiving countries, are not uncommon around the world. For example, Theoharides (2016) examines the impact of a labor ban on migration into Japan while Kosack (2015) looks at the long run effects of the Bracero program that ended in 1964.

[6]The equivalent of 185 million USD in 2015 dollars, and three times as much as US foreign aid received by Malawi in 1974 (Fagerns and Shurich (2004)).

baseline district level variables interacted with trend terms and isolate how districts receiving more capital because of the migration shock changed differentially, in decades following the migration ban. We use the quasi-experimental variation in migrant capital flows to assess how local trajectories of economic change in places with more versus less capital, conditional on the total number of labor migrants. The variation that drives differences in migrant capital across districts stems from differences in the timing of miner trips and the composition of miners from each district (e.g. share of novices versus experienced miners), each of which was strongly driven by demands of the gold mining sector in South Africa.

Our main finding is that in districts receiving the largest capital inflows due to the migration shocks, workers shift out of agriculture and into capital-intensive, non-farm service activities. These shifts begin in the first ten years following the end of migration, and continue, growing larger, into the second and third decades post-shock. Both women and men shift out of agriculture, and into the service sector, specifically into construction and the retail sector, and women also shift into the transport and communications sector. Using a Herfindahl index of the diversity of jobs in a district, we find that employment becomes more diversified over time in districts with larger capital shocks. Each additional one million USD received through migration shifted 1,100 jobs shift out of agriculture and into services. We calculate that each non-farm job created by 2008 cost USD880. While these shifts are not massive – Malawi is certainly no South Korea, or Vietnam – they do indicate a measure of structural change and a persistence of the impacts of this migration episode.

One limitation of our data is that we do not have information on sector of work prior to the migration shocks. In place of testing for pre-trends in employment across districts, we rule out pre-trends in variables strongly correlated with the sectoral allocation of labor: population growth and urbanization. We find that districts receiving the largest capital injections from migration were not growing faster or urbanizing more, in the decades before the migration shock. If anything, these districts were growing more slowly prior to 1966. After the migration shock, population grows faster and urbanization speeds up in high migrant capital inflow districts. These trajectories are sustained three decades after the end of the migration episodes. At the same time, we show that our main results are not driven by cross border migration within Malawi.[7]

We investigate some of the mechanisms behind these persistent effects of the one-time shocks. We match Census data with household income and expenditure surveys to investigate how accumulation behaviors changed over time in high versus low capital inflow districts. An appealing feature of these data are that we can measure most accumulation behaviors

[7]Our results are also robust to a range of robustness checks, including omitting the capital city, omitting population weights, and clustering standard errors in different ways.

before *and* after the migration shocks. We find little evidence that districts receiving larger capital inflows invest differently in agricultural capital over the long run. There are no large or significant differences in rates of farm tool ownership, or in livestock ownership. However, households in these districts do invest more in physical non-farm capital. Districts receiving more capital by 1977 have a greater share of households with higher quality walls and roofs, decades later. Finally, we show that before the migration shock, average rates of saving across districts are essentially zero in all districts. In contrast, two decades after the migration shocks, districts that received more migrant capital have higher savings rates, although the savings estimates are somewhat imprecise due to measurement error in these data. Together, these pieces of evidence are consistent with the idea that labor migration facilitated an initial round of capital accumulation, and through some combination of local demand shocks and expansions in the non-farm service sector, allowed sending communities to invest in productive capital and save at higher rates over the long run.

Because migration is the source of additional capital in our setting, we discuss how critical migration is relative to the capital shock in generating the long run employment effects.[8] Our empirical strategy leverages variation in capital generated by differences in the time profile and composition of migrants across districts. We have no direct evidence that human capital of migrants was (or was not) important for structural change we measure. However, we show that migrants overwhelmingly returned to farm jobs after the migration ban, and were employed in agriculture at much higher rates than non-migrant men. These patterns are not consistent with the notion that returning migrants moved into the non-farm sector, thereby kickstarting the process of structural change using some combination of their human and financial capital. Moreover, our results line up well with recent studies about how capital shocks affect local labor markets in other parts of the world. For example, Kaboski and Townsend (2011) find that capital injections increased income earned in non-farm work in rural Thailand over the medium run. Bandiera et al. (2016) find that asset transfer programs increase the chances of women working in higher productivity agriculture in Bangladesh over the medium run. In each of these cases, the amount of capital (financial or physical capital) in a community increased for reasons unrelated to migration. The additional capital facilitated workers working in different ways, which is what we find for our setting over the long run.

Our paper connects to a large literature in development that emphasizes how credit constraints restrict entrepreneurial activities in low-income countries. At a macro level, researchers have highlighted theoretical ways that credit constraints and financial frictions

[8]The idea of structural change through internal migration is part of the model outlined in (Foster and Rosenzweig, 2008). They show how growth in the non-farm sector could be stimulated by increased incomes earned by rural-urban migration and remitted back to rural areas.

affect the types of work that people can do, for example (Buera Kaboski and Shin, 2013), (Banerjee and Newman, 1993). These constraints have particular implications for entrepreneurs and the self-employed (e.g. Burgess and Pande (2004), who find that more banks facilitated more self-employment in India) and for expansion of the non-farm sector (e.g. Bustos, Garber and Ponticelli (2015) who find that the banking sector channeled agricultural surpluses towards the non-farm sector in Brazil). Yet, in the micro literature, recent field experiments conducted around the world have provided much more mixed evidence on whether relaxing credit constraints can lead to entry into, or expansion of, self-employment in entrepreneurial, non-farm work.[9] Our long run evidence from the Malawi setting suggests that at market-level, a lack of capital or access to credit may distort labor allocations within local economies and constrain structural change over the long run.

We also contribute to a large migration and remittances literature in two ways. First, we bring to light new and highly disaggregated administrative data documenting remittance flows over time at the level of the sending community in Malawi. Such data are typically very hard to find. Second, we measure impacts on market-level outcomes within a country over a long period of time using sub-national data from Malawian Censuses. Because prices can be affected by these market-level shocks, and inputs can reallocate in response, it is important to estimate market-level effects rather than focus on migrant households alone. Having quasi-experimental variation in capital shocks and enough data allows us to examine general equilibrium effects on the structure of local labor markets that persist over time. While these market-level effects echo findings from micro level studies of migrant households (e.g. (Yang, 2008)), the trade-off is that we cannot present a rich picture of how migrants themselves are affected by the large amounts of capital that come back. Nonetheless, we do the best we can with supplementary data to understand more about mechanisms.

Our results are relevant far beyond the context of Malawi. In many African countries, policy-makers are beginning to face the challenges of a rapidly growing youth population and a massive expansion in local workforces. Demographers predict the fastest future growth in the global workforce will occur on the continent. Fox et al. (2013) estimate that the rural non-farm sector – mainly in services, and particularly in household enterprises – may have to create jobs for about 65 million new workers in the next four years (see also Fox and Sohnesen (2012)). For these countries, temporary unskilled labor migration may present a practical alternative to waiting for industrial, agricultural, or trade revolutions that typically

[9]For example:McKenzie and Woodruff (2006), McKenzie et al. (2008), McKenzie et al. (2009), McKenzie et al. (2012), McKenzie et al. (2014), and Banerjee et al. (2015) analyze how cash grants, loans or microfinance, sometimes in combination with training, affect the probability of someone starting their own business, or the probability of expanding an existing small business. McKenzie and Woodruff (2014) provide a good review of a range of recent studies.

trigger structural transformation.[10] Together with the handful of papers that estimate the developmental impacts of seasonal worker programs (e.g. Gibson, McKenzie and Rohorua (2014); Kosack (2015)), our evidence from Malawi suggests that managed, temporary labor migration could be a useful tool for job creation in the service sector, and that access to capital is likely to be critical for facilitating a movement out of farming

The paper begins with a description of the labor market in Malawi, how it has changed over time, and the role of capital in farming and non-farm work. We describe the source of the migration shocks in the 1960s and 1970s and where the variation in capital inflows comes from. Then we lay out a conceptual framework for thinking about the impacts of these particular labor migration shocks on labor allocation across sectors. We outline our empirical strategy and data, before discussing main results. The second part of the paper presents evidence on how accumulation behaviors changed across communities over time, and discusses how our results can be interpreted in broader context.

2 Labor markets in Malawi

2.1 Declining importance of agriculture and a shift into services

In the 1960s, agriculture in Malawi accounted for 45% of GDP; by the early 1980s this had shrunk to one-third of GDP. At the same time, the share of manufacturing rose to 12% and the share of services in GDP rose to 45% (Chipeta and Mkandawire, 2004), indicating some measure of structural change in the country. Despite these shifts in production, most employment is still in agriculture, or connected to the agricultural sector.

Table 1 uses four waves of Census data from 1977 to 2008 to show how national employment rates in each sector of work have changed over time. In 2008, over half of all economically active (working and unemployed) men and almost 70% of economically active women were employed in agriculture. In 1977, 2.8% of women and 12% of men were in service sector jobs. By 2008, these numbers had risen to 21% for women, and 27% for men. These structural changes are reflected in the falling value of the industrial concentration index. We construct a Herfindahl index to describe how concentrated employment is in any one sector, for each district. Lower values of this index reflect lower concentrations, or more diversity of employment within the district. Over time, this index falls from 0.89 to 0.53 for female employment, and from 0.61 to 0.35 for male employment. This pattern of employment shifting from farm to non-farm sector, with non-farm jobs concentrated in services rather

[10] Bustos, Caprettini and Ponticelli (2016) is a recent example that analyzes the impacts of an agricultural technology shock on structural change in the labor market.

than manufacturing, strongly resembles patterns of structural change in other African labor markets over the last three decades (e.g. see (McMillan, Rodrik and Verduzco-Gallo, 2014; Fox and Sohnesen, 2012; Gollin, Jedwab and Vollrath, 2016)).[11]

To fix ideas about what non-farm work is in Malawi and to preview our discussion of how capital is used in production, we show the distribution of the top five non-farm occupations and industries for women and men in Figures 1A and 1B.[12] Retail trade tops the list of non-farm work: almost 40% of women and almost 30% of men work in the retail sector, with the next largest category being public schools and defense, and construction. Smaller shares of women work in health and cleaning sectors, and around 2% of men make furniture, or clothing. Occupational patterns are similar. Almost 40% of women work as shop assistants, 15% are teachers, 7% are food and beverage producers (e.g. beer brewers), and 5% each work in the medical sector (nurses) and as clerks/stenographers. One in four men works as a shop assistant, 11% and 12% work as brickmakers or carpenters, or security guards, and 6 to 7% work as bus or taxi drivers, or teachers. Overwhelmingly, the non-farm sector is comprised of people working in personal, general, and government services. Only a small share of non-farm employment is in small-scale (owner-operated) manufacturing enterprises at household level.

2.2 Relative capital intensities of farm and non-farm work

One stylized fact in the literature is that in contrast with farming, production in the non-traded non-farm goods and services sector uses almost no capital. For example, this is the case in well-studied ICRISAT villages in India (Foster and Rosenzweig, 2008).

Table 2 illustrates that the opposite is true in Malawi. We use data on rural households from Malawi's Household Income and Expenditure Survey conducted in 1997/8 to show how capital is used in farm and non-farm production. All households in the sample are engaged in farming of some sort, producing some combination of food crops, cash crops, or livestock. One fifth of these households also own and operate at least one small business. Most non-farm work is conducted in household enterprises, and operated by self-employed people. We group all non-farm businesses that are run by a single, self-employed worker into the service sector.

The first four columns of Table 2 show average annual values of working capital, physical capital, land capital and total capital used in farming and non-farming activities. We

[11] Labor force participation rates for men and women have always been high in Malawi. Between 84% and 96% of working age people were working, or looking for work in different decades (results not shown).

[12] These bar charts are drawn using the 1998 Census, for which occupation and industry of work data are recorded at the two digit level. Prior Census years do not capture this level of detail for sector of work.

compute total revenues (the value of home plus market production), net value added (revenue minus input costs), effective labor (total number of workers employed in the household business or farm weighted by the share of the year actually employed), and value added (or average product) of labor in farm and non-farm enterprises.[13] All values (except for effective labor units) are measured in 1997 USD. Details of the dataset and variable construction are in the Data Appendix. Panel A of the table presents characteristics of farm businesses for the rural sample while Panel B shows data for non-farm businesses.

Three main facts stand out from this table. First, non-farm work uses more than twice as much capital as farm work, with large differences in the amount of working and physical capital used in production. Working capital is required to purchase all of the recurring non-labor inputs into production, for example: hybrid seeds and fertilizers for farms, business inventories for retail businesses, fabric for tailoring, etc. Physical capital includes assets owned by the household and valued using household reported values. We classify hoes, axes, sickles and pangas as farm capital, and pounding mills and bicycles as non-farm capital. On average, households use 172USD in working capital in their home businesses, compared with only 20USD on their farms. non-farm businesses also use ten time more physical capital (USD139) in their enterprises, relative to the average farming household that only uses 13USD. The value of land cultivated in farms is around 125USD, and we assume that no land is used in household enterprises.[14] Even under this extreme assumption, non-farm work still uses almost twice as much total capital relative to an average farming household (311USD versus 158USD).

The second point to note is that annual revenues are over five times as large in the non-farm sector than in farming. Households earn 540USD per year in non-farm work and less than 100USD per year in farming, including the value of home production. For comparison, GDP per capita in 1998 in Malawi was 166USD.[15] Effective labor used in farming is less than one full time worker per year (0.44) while non-farm businesses use more effective units of labor (0.77). non-farm businesses use on average 12% more capital than farming (311/0.77 versus 159/0.44).

The third point is that labor is also more productive in the non-farm services sector than in farming (Table 2, final column). The net value added of labor is the difference between annual revenues and total running costs (working capital plus labor costs) in each of the farm or non-farm businesses. We divide this by effective labor units to create labor productivity

[13]We followed methods used in Gollin, Lagakos and Waugh (2014) to compute value added of labor inputs.

[14]Most farmers farm on very small plots of land (average size is 0.28ha, or about half the size of an American football field or two thirds the size of a soccer field). In general, land markets are thin with most land held and allocated through customary practices (Restuccia and Santaeulalia-Llopis, 2015).

[15]World Bank Databank: `http://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=MW`.

measures in the final column. On average, workers are 10% more productive in non-farm work than in farming. This gap in average labor productivity across sectors resonates with a recent literature on misallocation in low-income countries (see, for example, Gollin, Lagakos and Waugh (2014)).[16] While we do not directly address issues of misallocation in this paper, in the background is the notion that some combination of capital, credit and land market imperfections contribute to the productivity gaps in Table 2. This is the background against which we examine the impacts of additional capital inflows from migration.

2.3 Migration as an alternative sector of work

International migration has always offered another sector of work for Malawians, most often men. In Dinkelman and Mariotti (2016), we document the history of organized legal mine migration from Malawi to South Africa in the twentieth century. This migration was administered by the mines' labor recruiting agency, the Witwatersrand Native Labour Association (*Wenela*).[17] Importantly, mine work was much more lucrative than wage-earning opportunities at home. Workers could earn at least 2.5 times more on the mines per year, relative to working on an agricultural estate in Malawi. And, because migrants were required by contract to save up to 60% of their earnings and receive this as deferred pay upon repatriation, most of the migrant money always made it back to Malawi. Deferred pay, a form of compulsory remittances, was the basis of their ability to accumulate capital for use back in rural sending regions.

In Figures 2a to 2c, we illustrate the variation in migration and migrant capital that form the basis of our identification strategy. Data sources are described in more detail in Section 4 and in the data appendix.[18] Figure 2a (reproduced from Dinkelman and Mariotti (2016)) shows the number of Malawian migrants employed on South African mines in each year from 1950 to 1990. The migration episode we consider is the massive ramp up of migration in the late 1960s and the equally dramatic decline in migration in the mid-1970s. Before the middle of the 1960s, migration to work on South African mines was limited by strict labor quotas on *Wenela* recruiting that were never larger than 2% of the working age male population.

[16] In fact, our individual level data show a somewhat smaller gap in value of output per worker than is shown for the typical country in that paper. Gollin, Lagakos and Waugh (2014) calculate the average productivity gap is around two. We do not adjust for any human capital differences across households in our calculations.

[17] Members of the South African Chamber of Mines gave this agency authority for recruiting mineworkers from across the southern African region. *Wenela* merged with the South African recruiting agency in the mid-1970s and became *Teba*, The Employment Bureau of Africa. Much of the archival material we use in our analysis are original documents from *Wenela/Teba*.

[18] Most of the data used to construct these figures are from archival data that we digitized from historical records of the Witwatersrand Native Labor Association.

In 1967, a new labor treaty removed the quota and migration expanded from 40,000 to over 120,000 men in five years. The labor migration surge ended in April 1974, when a *Wenela* plane returning to Malawi crashed, killing all miners aboard. Then-president Banda banned all labor recruiting in the country and recalled all miners. The number of Malawians working on South African mines fell to zero in the two years following 1974. By 1977, Banda had realized that mining money represented a crucial source of foreign reserves for the country and rescinded the ban on migration. However, migrant flows never returned to prior levels. By the 1980s, *Wenela* had redirected recruiting towards the South African labor market. Figure 2a shows clearly the impact of the removal of labor quotas in 1967 on Malawian mine workers and the impact of the labor ban in 1974.[19]

Flows of money paralleled the flow of migrants back to Malawi between 1967 and 1975. In Figure 2b, we use archival data to plot the log of USD (in 1975 dollars) received by Malawians over time.[20] We plot the total amount of money (deferred pay plus remittances plus deposits) flowing back to Malawi and the total deferred pay (forced savings) returning along with workers. From 1966 to 1974, total capital flows rose by about 20%. The first red vertical line indicates the removal of the labor quota in 1967. After this, deferred pay flows increased slowly, and then start to pick up later in the period when migration surges. Money flows spike up after the plane crash (indicated by the second vertical red line) as all miners were reptriated. The later part of the migration period (1974-1975) represents the period of largest, coordinated capital flows back to rural districts in Malawi. Each migrant returning from an 18-month contract would have received between 130USD and 295USD, depending on when he left.[21] Total deferred pay inflows over the entire period were 53 million USD. At peak migration, Malawi received 2.5 million USD from miner earnings per month, or about 100,000USD per district.

A district could receive more capital than other districts in one of four ways. Districts with more migrants received more deferred pay. But, conditional on the number of migrants, when those migrants left and returned between 1967 and 1975 would have total amount coming back as deferred pay, because the timing of their trips would have affected average wages. In the mid-1970s and early 1980s, the mining industry chose to raise mining wages alongside large increases in the global gold price(Crush, Jeeves and Yudelman, 1991) (see

[19] In our prior paper Dinkelman and Mariotti (2016), we use different components of these migration shocks to isolate the impacts on education profiles of communities over the long run.

[20] All amounts are converted (from GBP or MWK) to USD at the fixed 1975 exchange rate of 1.2 MWK to 1 USD.

[21] We take the total deferred pay flowing back to Malawi in each year from 1967 to 1975, divide this by the number of migrants employed in South African mines two years prior (to account for the two year contract), to come up with this range. This is almost surely an underestimate of the total capital per returning miner, because it assumes that each migrant had only one migration episode.

Figure 2c). Capital inflows would have been larger in districts in which more migrants left later in the period, relative to earlier in the period. Relatedly, districts with more migrants closer to the end of their contracts in 1974, at the time of the labor ban, would have received more deferred pay after the ban. Finally, districts with a larger share of migrants on repeat contracts – or, a smaller share of novices – would have received more capital. This is because miners earned a standard raise each time they recontracted. Changes in the types of migrants recruited over time were driven by the demands of the gold mining industry, rather than by changing patterns of labor supply in Malawi.[22] In our empirical work, we use district-level variation in capital received, conditional on total number of migrants per district. These district-level differences stem from differences in the timing of migration (when more men left the district) and the composition of migrants (shares of novices versus repeat miners). In our discussion, we describe how the source of this variation in capital may contribute to our results.

3 Conceptual framework

Conceptually, there are three mechanisms through which capital from migrants might have affected rural sending regions over the long run. The first is through a direct income channel: the return of capital could give rise to a local demand shock. Migrants return, bringing money with them, which increases demand for – and hence viability of – small businesses in the non-farm sector. Migrants may also bring with them a change in consumption preferences, desiring more market goods. These two effects bid up the prices of services, facilitating entry and expansion of the non-farm sector, at least in the short run. This mechanism is similar to the demand externality highlighted in big push models like Murphy, Schleifer, and Vishny (1989).[23] For this demand externality to have large enough effects to affect future labor markets, households must continue to accumulate, even after migrant income runs out, and especially once migration is no longer an option. This happens if production in the non-farm sector generates larger surpluses than production in the farm sector.

The second way that additional capital could reallocate labor across sectors is by releasing capital constraints in the capital intensive non-farm sector. If a minimum amount of capital is required to start and/or expand non-farm household business, then more local capital would create an incentive for farmers to leave low productivity farming and enter higher

[22]Unfortunately, we have no data on composition of miners at district level, over time.

[23]Economic growth in a model with non-homothetic preferences is also one of the primary mechanisms for structural change in the macro literature (Herrendorf, Rogerson and Valentinyi, 2014). As people earn higher incomes, they start to buy relatively more of the non-farm goods, expanding employment in that sector and reducing employment in the agricultural sector.

productivity jobs in self-employment. These new businesses may be started by returning migrants, or may simply be the result of having more capital available in the entire market.[24] As long as non-farm work generates higher returns than farm work, this mechanism provides a way for households to continue to accumulate after the end of the migrant income shock, thereby generating a persistent impact on the sectoral allocation of labor.[25]

Third, if capital is more valuable in agriculture than in services, we might see more investments in farm capital (e.g. physical capital, seeds, fertilizers) follow from the infusion of migrant earnings. Once minimum food production is reached with the investment of new capital, excess labor in farming could be released to the non-farm sector, especially in a closed economy setting, which is a reasonable assumption for districts in Malawi (Robinson, 2013).[26] However, if there are other market imperfections – for example, if farmers cannot access or buy more land, or find it difficult to buy inputs like seeds and fertilizers – then this agricultural investment channel would be less relevant for shifting workers out of farming. These other types of market imperfections are likely to be important in Malawi(Beegle, Galassoz and Goldberg, 2016; Restuccia and Santaeulalia-Llopis, 2015).

Underlying each of these three channels is the idea that there is insufficient capital in the local economy to break out of a poverty trap, or that incomes before the capital shock are so low that savings cannot be sustained, and incomes cannot be spent on anything other than food. An increasing supply of capital in the economy enables a big push through some combination of the above channels, allowing households to spend more on nonfood items and save; enabling other households to start up small businesses to supply this new demand (Rosenstein-Rodan, 1943; Murphy, Schleifer, and Vishny, 1989). Because small business are more profitable than farming, this initial impetus to the non-farm sector multiplies over time, as savings accumulate and sustain the impact of the initial income shock.

In our empirical work, we examine how economies evolved after the end of the migration episode, once all migrants have returned to the economy. We test for whether capital had persistent impacts on local labor markets, conditional on the number of migrants from that

[24]Credit constraints in the non-farm sector is part of the explanation in Yang (2008) for why increases in migrant remittances allow expansion of some entrepreneurial activities in the Philippines. In our setting, we show later on that returning migrants are not the source of new service sector businesses in Malawi, at least in the first years after the labor ban.

[25]Financial intermediation, or the role of capital in the economy is a mechanism for structural change highlighted in Buera Kaboski and Shin (2013). The importance of differential capital intensities across production sectors is another mechanism that drives structural change in the macro literature (Herrendorf, Rogerson and Valentinyi, 2014).

[26]The effects of this additional capital in agriculture would be similar to the effects of a labor-saving technology shock on labor reallocation (e.g. as modeled in Bustos, Caprettini and Ponticelli (2016)). Financial capital may also be augmented by changes in the human capital owned by migrants. We return to discussing the role of migrant human capital in the last section of the paper.

district. We test for evidence of investments in farm capital, and in non-farm capital, and we investigate whether communities with the largest capital inflows were able to save or invest more, continuing the capital accumulation long after the end of migration.

Mitigating against us finding any long run effects of the initial capital shock on specific districts is the possibility that capital returning to Malawi might move across space. In other settings, financial infrastructure is the key conduit for savings from the agricultural sector to flow towards the non-farm sector in urban areas (e.g. Bustos, Caprettini and Ponticelli (2016)). In Malawi, the lack of financial infrastructure limits the spatial mobility of capital. Miners and mining families had money transferred to them through the recruiting station network, or through the local post office. Neither of these institutions were lenders of money, so neither could be a force for formal financial intermediation. In the years since the end of labor migration, Malawi's banking network has barely changed. As late as 2007 (the latest year for which data exist, (The World Bank, 2014)), there were only 1.47 ATMS and 1.92 bank branches per 100,000 people respectively, and 123 bank accounts per 1,000 individuals. We therefore expect the effects of capital returning to Malawian labor migrants to be concentrated in districts to which this capital returned.

4 Empirical strategy and data

4.1 Main specification

To isolate the persistent effects of more migrant capital at market-level, we specify the following empirical model for labor market outcomes Y_{dt}:

$$Y_{dt} = \sum_t \alpha_t K_d Decade_t + \sum_t \beta_t L_d Decade_t + \kappa_t + \delta_d + W_d Trend_t \lambda + \epsilon_{dt} \quad (1)$$

where Y_{dt} is, for example, the share of workers in the agricultural sector or the services sector, d is the district, t is the decade (1977, 1987, 1998 or 2008), K_d is the amount of deferred pay in millions of USD received by district d between 1966 and November 1975, L_d is the total number of migrants in thousands returning to each district between 1966 and 1977, $Decade_t$ is a set of decade dummies for one, two and three decades after the end of migration (1987, 1998 and 2008 respectively), κ_t is a decade fixed effect, δ_d is a district fixed effect, $W_d Trend_t$ is a vector of the interaction of baseline district-level covariates with a linear trend term, and ϵ_{dt} is the idiosyncratic error term. Baseline district covariates include literacy rates and population density in 1945, the share of men and women not earning any cash income in 1966 as a proxy for the local economy prior to the migration shocks, the

share of men and women married in 1966, an indicator for whether the district is a malaria area, and two region indicators. Regressions are estimated separately for men and women. Robust standard errors are clustered at district level. We report statistical significance using p-values from the small sample t distribution to account for the small number of districts (24).[27]

Decade fixed effects control for aggregate changes in the labor market that affect all workers equally, for example, a nationwide drought that occured in the early 1990s. District fixed effects control for constant average differences in labor markets across districts, for example districts with lake access could always support work in fishing industries. These controls also standardize for population size of the district. Trend interactions flexibly allow districts with different initial population densities, literacy rates, marriage rates and other baseline variables to evolve differently over time. By controlling for L_d, the number of migrants from the district, we isolate the impact of K_d across districts with the same number of migrant men. The capital shock is measured at the level of the district, because we want to capture changes in district-level outcomes.

Both sign and significance of each of the α_t parameters is important. α_{1987} tells us the percentage point change in the relevant employment outcome between 1977 and 1987, the first decade after an additional one million USD was received per district, while α_{1998} and α_{2008} give us the same parameter for the later decades, in 1998 and 2008. If effects of migrant capital dissipate over time, we should see $\alpha_{1987} > \alpha_{1998} > \alpha_{2008}$ for outcomes where the capital shock has a positive impact. Alternatively, if labor market effects of the shock persist and grow over time, we should see $\alpha_{1987} < \alpha_{1998} < \alpha_{2008}$. Without data prior to 1977, our specification only allows us to estimate the effect of the capital shocks on differential *changes* (rather than level differences) in employment outcomes across districts after 1977.

Our main identification assumption is that districts that receive more capital before 1975 would not have evolved differently compared with those receiving smaller amounts of capital, in the absence of the capital shock. Importantly, our comparison of labor market trajectories from 1977 onwards controls for the total number of migrants before 1975. Differences across high and low shock districts are generated by differences in the timing and composition of migrants, not the number of migrants.

One potential concern is that excess labor in low capital shock districts was transitioning into services before 1975, while high capital shock districts exported their excess labor to the South African mines. The cessation of migration would then be concomitant with the

[27]We show in the Robustness Appendix that our results are robust to using wild cluster bootstrapped standard errors. The p-values generated from the wild cluster bootstrap procedure reflect largely the same pattern of significant results as the p-values taken from the small sample t-distribution.

returning migrants choosing to go into small businesses in their home districts. In this case, we should see a convergence in the shares of workers in non-farm work across high and low capital shock districts, because they started from different baseline shares, and because migration is itself a substitute for non-farm work. We show that this is not the case, empirically.

A limitation of the Census data is we cannot test for pre-trends in local labor market outcomes across high and low capital shock districts because these data were not captured prior to 1977. Instead, we check for pre-trends in two variables that are strongly correlated with local labor market structure: population density and urbanization. If we see no differences in population growth across areas with more versus less migrant capital, before the migration episodes occur, this bolsters our claim that prior to the capital shock, these economies were not changing in different ways. Because these measures are interesting outcomes in their own right – urbanization is another component of structural transformation – we also estimate how these outcomes evolve differently after the shock across high and low capital shock areas. We implement these tests using the same structure as equation 1 and include earlier years of Census data from 1945 and 1966.

4.2 Data and summary statistics

4.2.1 District-specific capital flows and migration

Capital flows at district-month level from October 1967 to November 1975 are measured using archival material from administrative records. Three categories of monies were recorded: deferred pay, remittances and other deposits made by miners. As mentioned before, deferred pay was set by contract; remittances and deposits were voluntary. 89% of all monies returning to Malawi were in the form of deferred pay. When we refer to money flows in our analysis, we mean this involuntary deferred pay. Amounts are converted to USD, aggregated to district-level over the ten year period, and scaled so that one unit of K_d represents a one million dollar transfer over this period.

To construct district-specific numbers of total migrants between 1967 and 1977, we multiplied the number of ever migrants at district-level by the national share of men who had returned to the district the the ten years before 1977. We do not have have data on district-specific numbers of migrants leaving or returning each year between 1967 and 1975.

4.2.2 Labor market and population outcomes

We measure labor market outcomes, population outcomes, and district-level covariates using six waves of Census data from 1945 to 2008. We digitized historical Census data available

at the district-gender level from 1945, 1966 and 1977 and combined this with Census data from 1987 (the 10% sample), 1998 (100% sample) and 2008 (10% sample). We weight up the 10% samples to the full population when creating these data cells. Details of the specific variable construction are in the data appendix.

Key labor market variables are defined for men and women, using labor market questions that remain the same across survey instruments. Broad industry of work is available for economically active individuals 10 years and over. We use these broad measures of industry – agricultural, manufacturing and services – to look at labor reallocation across sectors, as well as a finer breakdown of industries in the non-farm sector: general manufacturing, retail, transport and communication, and all other services, which include personal services and government employment. Using the broader measures of industrial sector, we construct a Herfindahl index capturing the diversity of employment within the district.

Data on total population and population by gender are available for each district from 1945 onwards, and on urban shares of population from 1966 onwards. We use the 1966, 1977 and 1987 Census to construct district-specific measures of the number of cross-district inmigrants, outmigrants, and net migration rates before and after the labor migration shock period. Migration questions are not asked in the 1998 Census. We use these measures as outcomes to test whether internal migration (across district borders) differs across districts with more or less capital inflows.

Table 3 present summary statistics from the data. There are almost 55,000 working age men in an average district in 1977, and almost 20,000 of these men had worked abroad at some point by 1977. The large increase in migrant prevalence occured between 1966 and 1977. The lower part of the table shows means of important covariates that are interacted with decade trend terms in our empirical work. Only 8% of the youth population was literate in 1945. Population density was around 30 people per square kilometer. 28% of districts are high malaria risk, based on average altitude in the district. About half of all districts grow some type of export crop (tobacco, cotton, sugar or tea) on an agricultural estate. And between 38 to 47% of men and women were not earning any cash for work activities in 1966. We use these last two variables as indicators for the pre-existing structure of the local labor market.

5 Main results

5.1 Structural change across districts with high versus low migrant capital

Figures 3 and 4 use the raw Census data to illustrate our basic result of differential structural change in the labor markets of districts with different levels of deferred pay from returning migrants. The first figure shows female employment by sector over time, the second figure shows patterns for men. In each figure, we plot the average share of workers in the agricultural or services sector, for each decade (1977, 1987, 1998 and 2008), drawing separate lines for districts with above (solid line) and below (broken line) median levels of deferred pay by 1975. We do not control for any variables in these figures, but simply plot the raw data by gender, year, and district type.[28]

Shares of men and women working in agriculture start out roughly the same in high and low capital shock districts in 1977, just three years after the labor ban. By 1987, they start to visibly diverge, with the shift out of agriculture occurring faster in the high capital shock places. Patterns in the service sector are the reverse of this: while high and low capital shock districts start out at similar rates in 1977, by 2008, there are much larger shares of workers in services in the high capital shock districts. Labor shifts into services to a greater extent in districts with the larger capital inflows. The effects of the capital shock persist, and grow larger, over time. Our regression analysis next investigates whether these patterns hold when we control for district fixed effects, year fixed effects, and interactions of baseline district variables with a trend term.

5.2 Impacts of migrant capital on broad sector of work

Table 4 presents our main results for the broad categories of employment in agriculture, manufacturing and services, and the measure of employment diversification, the industry Herfindahl index. Panel A shows estimates for women, Panel B for men. The unit of observation in each regression is the district-gender-decade. For each outcome, we present estimates of α_t from equation (1), including all district fixed effects, decade fixed effects, and interactions of all baseline district-level controls with a trend term. For each outcome, the first column presents estimates excluding controls for the number of migrants in each district, and in the second, we include these controls and present estimates for α_t and β_t.

[28] We omit Blantyre from these figures, since the district is somewhat of an outlier with respect to total deferred pay inflows. Our regression results are robust to including or excluding Blantyre, because they control for district fixed effects, which these figures do not.

Regressions are weighted by population.

The table shows that in districts that received larger capital inflows between 1966 and 1977, more female and male workers shifted out of agriculture, into manufacturing (for women) and services, and the industrial concentration of employment fell. These effects are still present, although attentuated, when we control for the number of migrants carrying back this capital. Districts with larger capital flows experienced more structural transformation, as labor reallocated away from agriculture into the non-farm sector. For all sector of work outcomes in Panel A, the p value for the joint test of the migrant capital interaction terms strongly rejects zero. The impacts of migrant capital on labor reallocation persisted for at least three decades after the end of migration.

Are the magnitudes of these shifts sensible? For each additional million dollars that flowed back to a district before 1977, the share of women working in agriculture fell by 0.36 percentage points in the first decade following the shock, by 1.26 percentage points in the next decade, and by 1.6 percentage points by the third decade after the shock. These effects are between one and two thirds as large when we control for the number of male migrants: in column (2), the share of women in agriculture fell by 0.1 percentage points by 1987, and by 0.8 percentage points in the second and third decades after the shock. Column (4) shows smaller shifts of female labor into manufacturing (between 0.09 and 0.1 percentage points) and column (6) shows larger shifts of women into services (0.8 percentage points by three decades after the shock).

Labor reallocation in the wake of the migration shock reduced the concentration of employment in agriculture within districts. The average value of the Herfindahl index is 0.8. In districts with larger capital shocks, this index fell between 0.006 and 0.015 in the decades following the end of migration, indicating a larger reduction in concentration of work – or more diversification – in these districts. These effects are also somewhat attenuated when we control for the number of migrants in column 8: the index falls by 0.003 and 0.009 in the two decades after the shock.

Panel B shows similar patterns of structural change for men. More capital coming into the district also shifted male employment away from agriculture, and towards services. The share of men in agriculture fell by 0.6, 1.1 and 0.5 percentage points respectively in the first, second and third decades after the shock. In column 2, these effects are attenuated when controlling for returning migrants, but the share of men in agriculture still fell by between 0.4 and 0.7 percentage points in two decades following the end of migration. Shifts into the service sector were positive. Male employment in services increased by 0.1, 0.5 and 0.1 percentage points respectively, although are only statistically significant in 1987.[29]

[29]The p-value for the joint test of the capital shock interaction terms reject no impact of capital on

These changes are reflected in increased diversity of work for men (columns 7 and 8): the concentration index falls significantly in the first and second decades following the end of migration, with magnitudes (relative to means) similar to effects for women.

For both men and women, the number of returning migrants reinforces the effects of the capital shock on sectoral allocation of labor, having a multiplier effect on jobs in the non-farm sector. For each additional 1,000 migrants between 1966 and 1977, the share of men and women in agriculture falls by between 0.1 and 0.3 percentage points and the share in services increases by between 0.1 and 0.3 percentage points. The size of the coefficients on these migrant interaction terms are very similar across men and women. Adding up effects over time, these 1,000 additional migrants generated 906 how many additional service sector jobs across men and women. Compared with the persistent impact of the capital shock, the impact of migrants grows smaller over time.

Overall, the shifts we see are positive, and persistent, although not massive. Nonetheless, they suggest some measure of structural change facilitated by exposure to labor migration opportunities. In an average district, with 58,000 women in the economically active population, an additional one million USD received by 1977 moved 463 women out of agriculture and a similar number of women into the service sector by 2008. Accumulating coefficient estimates for each of the three decades, this translates into 1,815 fewer women in agriculture, 142 more in manufacturing and 716 more in services. For men, the corresponding numbers (given an average of 57,000 men in the labor force at district level) are 4,400 fewer farmers, and 279 more service sector workers. We calculate a cost of 880USD per non-farm job created. Taking men and women together, an additional 2,094 more jobs were created for every one million USD received.

5.3 Impacts of migrant capital on narrow sector of work in non-farm sectors

What types of manufacturing and service sector work developed in high capital shock districts, in the thirty years post-migration? Table 5 presents a finer breakdown of sector of work for the non-farm sectors: general manufacturing and construction (we omit mining, since shares in mining are so low), general services, retail, and transport and communications. General services include personal services, business services (advertising, or insurance, banks and engineers, legal services, accountants) and other services (e.g. barbers, tailors, typists, public sector workers). The retail sector includes wholesale and retail trade of food, fuel and other goods, hotels and restaurants, car repairs etc. Transport includes transport

employment in agriculture and service sectors for men.

of goods and/or people, including using buses, taxis, boats, bikes, storage/warehousing, and telecommunications.

Men and women experience similar reallocations across sector of work groups. For each additional million USD received before 1977, the share of women working in construction rose by between 0.04 and 1 percentage points, in general services by 0.1 percentage points, in retail by 0.3-0.6 percentage points, and in transport by 0.1-0.2 percentage points. Relative to mean levels of employment in each non-farm sub-sector, the largest increases for women were in construction and general services. For men, more capital in the district resulted in shifts out of manufacturing (0.1-0.4 percentage points) and transport (0.1 perecentage points) and into construction (0.2-0.5 percentage points) and retail (0.1-0.6 percentage points). The largest relative shifts for men were towards construction. For women, the impacts of the capital shock on movement into construction, services and retail persist and grow larger over time. For men, there are no consistent patterns over time.

5.4 Population growth and urbanization

Our identification assumption is that districts receiving more migrant capital between 1966 and 1977 would have experienced the same changes in local economic conditions in the absence of the migration shocks. The raw data in Figures 3 and 4 suggest that in 1977, the structure of work in high and low capital shock districts was very similar, and only started to diverge over time. To check whether these economies were changing differently *before* the capital inflows, we check for evidence of pre-trends in two important variables that are correlated with differences in local economic conditions: population growth and within-district urbanization rates.

We estimate versions of equation (1) using population variables P_{dt} measured at district-year and sometimes gender and age group level as outcomes. We control for number of total migrants between 1966 and 1977 in all regressions. t now includes six years of Census data from 1945 to 2008 for population outcomes.[30] Regressions are unweighted, and standard errors are estimated as before.

Figure 5 plots estimates of α_t, the relationship between the amount of capital received by each district between 1966 and 1977, and district-level population before and after the migration surge. Standard errors bars are included, and the omitted category is 1945. Each point on the line represents the marginal impact of receiving one million USD of deferred pay between 1966 and 1977, on the level of population in the district in each Census year.

[30]Nyasaland was part of a federation with Northern and Southern Rhodesia (Zambia and Zimbabwe) at the time of the 1956 Census, and data are not available at district-level in this Census.

Relative to a district receiving no deferred pay, a district that was going to receive one million USD in capital between 1966 and 1977 had lower population prior to the capital shock. After 1966, this pattern reverses. Districts receiving more deferred pay start to increase in size, and significantly so, by 1977. This growth is sustained in the ensuing years: after the end of the migration shock, the districts with more capital continue to have larger populations, in 1987, 1998 and in 2008. Although confidence intervals are wide, the impact of the capital shock on population is positive and significant in 1977 and in 1987.

Table 6 presents a set of estimates from these population regressions, as well as for log population (so we can examine impacts on growth rates), log female population (so we can rule out the growth is mechanically related to returning migrants), the log of population in different age groups (under age 5, ages 5 to 18, and over age 18, so we can investigate a potential fertility impact of returning migrants), and the share of population in urban areas (so we can investigate urbanization).

In the first column of Table 6, we see the estimates that are plotted in Figure 3. Patterns of coefficients for the outcomes log of population (in column 2) and log of female population (column 3) are the same. One decade before the end of migration, total population and female population were growing more slowly in districts that were going to receive large capital inflows. By the end of the labor migration period (1977, end of migration), total population and female population in the high capital inflow districts had increased by 2.8 percentage points and 1.8 percentage points respectively. This growth continues and grows larger over time in 1987, 1998 and 2008. By 2008, districts that experienced the largest capital inflows were growing 4.2 percentage points faster than other districts. Female population was growing 3.3 percentage points faster.

Columns 3 to 5 show that the fastest population growth occurred in the youngest (under 5 age groups). This suggests that returning migrants and migrant capital may have affected population growth directly, through increased fertility or reduced infant mortality.[31] Population in older age groups continued to be higher in districts with the largest capital inflows, although the coefficients on these interaction terms in columns 3 to 5 are not statistically significantly different from zero.

Figure 5 and Table 6 provide powerful arguments against concerns that districts receiving the largest capital inflows between 1966 and 1977 were already on a growth trajectory before the migration shock occurred. They also show that the capital shocks induced some population growth that persisted over time, that was not simply an artifact of returning male migrants.

[31]We leave a more detailed investigation of the demographic impacts of the migration shocks to future work.

Shifts in the location of economic activities from rural to urban areas are an additional aspect of structural change. The results in Table 6 show that the increase in population in response to migrant capital is accompanied by increasing urbanization rates. By 1977, districts that received one million USD more than other districts had 0.4% more of their population living in an urban area, a 10% increase in the urbanization rate. This gap in the share of population in urban areas persists, and grows larger over time. By 2008, districts that had larger capital shocks in the 1970s were 0.6%, or 15% more urbanized, relative to districts with no capital shocks. These urbanization results suggest that internal population rearrangements may have been part of the explanation for structural change in rural labor markets.

5.5 Does internal migration drive structural change?

If internal (cross-district) migrants are always more likely to work in the service sector, any district with higher positive net migration rates (number of inmigrants minus number of outmigrants as a share of the district level population) could see shifts in the share of workers in the service sector and away from farming purely because of the movement of jobs across space. This compositional shift in the workforce would be part of what we estimate in high capital inflow districts. A movement of labor towards districts receiving more money could itself be the result of the demand channel through which increasing capital affects rural labor markets.

To investigate this possibility, we use internal migration information from the 1966, 1977, 1987 and 2008 Census. From these Census waves, we calculate the number of people who were born in a district, the number who currently reside in a district, and the number who have left their district of birth or moved from another district of birth to their current district of residence.[32] We compute three measures of internal migration: the number of inmigrants (people currently residing in a district who were born elsewhere), the number of outmigrants (people born in the district but currently residing elsewhere), and the number of netmigrants (inmigrants minus outmigrants). We express each of these numbers as a rate per 1,000 residents currently living in the district.

We estimate (1) using these migration variables $MigRates_{dt}$ as outcomes. Table 7 presents estimates of α_t, the impact of migrant capital inflows on inmigration, outmigration, and netmigration rates in the district. The omitted category is the interaction between the Census 1966 interaction and total deferred pay received by the district between 1966 and 1977.

[32]Internal migration questions were not asked in the 1998 Census.

Overall migration rates across district boundaries are high. There are 275 inmigrants and 278 outmigrants for every 1,000 residents. Because each district receives a lot of inmigrants and sends a lot of outmigrants to different districts, the average net migration rate is low, at 3 per 1,000 residents, or 0.3%.[33] If we take signs and magnitudes at face value (ignoring the lack of significance), districts receiving more capital look like they have less net migration (more outmigration, less inmigration) after 1966, although the size of these effects shrinks over time. However, none of inmigration, outmigration, or net migration are significantly higher or lower in districts that receive the largest capital shocks in the 1960s and 1970s. A movement of service sector workers across districts, towards areas of high capital inflows, cannot account for our main employment reallocation results. In other words, migrant capital inflows changed the sector of work for incumbents.

6 The persistence of accumulation

We investigate three ways in which the impacts of the capital shock could have persisted to generate long-run shifts out of agricultural work and into the service sector. First, we look for evidence of investments in capital used in agriculture. Second, we examine what happened to physical investments in the non-farm sector. Third, we look for differences in savings rates across communities over time. All outcomes are measured at district-level, across different Census years. Most outcomes are measured both before and after the migration episode. We estimate regressions that take the form of equation 1, but where t now includes observations measured in 1968, as well as in later years.

6.1 Investments in farm and non-farm physical capital over the long run

In Panel A of Table 8, we look at how ownership of productive farm assets changed in the wake of the migrant capital shock. We measure ownership of hoes, pangas, any livestock, and oxcarts. Outcomes are taken from the National Sample Survey of Agriculture in 1968 and the National Household Income and Expenditure Survey data in 1998 and weighted up to district level using sample weights (see Data Appendix for details). For hoe, panga and livestock outcomes, we can measure the share of households owning any of these items before, and twenty years after, the migration shock. Oxcart ownership is only measured in 1987, 1998 and 2008. Overall, there we find no evidence that districts with more capital were

[33] Marriage migration is likely part of this internal migration, as different areas of the country follow matrilocal or patrilocal marriage customs.

investing in more farm-specific capital over time. This lack of impact on farm investments lines up with the low levels of physical capital in farm businesses reflected in Table 2.

In Panel B of Table 8, we examine changes in ownership of assets that are used more generally in non-farm work. We measure the share of households in the district in a given year that have a radio, piped water, durable walls, a durable roof, and both durable walls and a roof, and at least one bicycle. Radio ownership is measured in all Census waves, while the other outcomes are measured in a subset of years. We indicate which years of data are used in each regression in the table. All outcomes in this panel, except piped water, are measured prior to the migration shock (1968/9) and for some years after the shock.

In districts with large capital shocks, there is an initial increase in the share of households with a radio in 1977 (1.4 percentage point increase) and increases in the share of households with durable walls and roofs, and a durable roof alone, in the ten years after the shock. There is a 1.3 percentage point increase, or 10% increase, in the quality of housing in high capital shock districts. This result ties in nicely with changes in the sector of work outcomes from Table 7. The fact that we see more men and women employed in the building and construction sector is consistent with there being more improved homes in the district. Although investments in home quality could be considered part of consumption expenditure, property investments have been used as an indicator of entrepreneurship in other settings (e.g. (Yang, 2006, 2008)). For many types of jobs in the service sector, a more durable home may be an important investment in protecting inventory (for retail trade) and/or for offering services (e.g. as a restaurant, bar, hairdresser etc).

6.2 Impacts of migrant capital on savings rates in the long run

We combine information on district-level savings rates from the 1968/9 National Sample Survey of Agriculture (the income and expenditure module) and the 1997/1998 National Household Income and Expenditure survey (see Data Appendix for dataset construction). In both datasets, we construct the average savings rate of the district by dividing the difference between annual incomes at district level and annual expenditures at district level by total annual incomes at district-level. Survey totals are constructed using weights. These variables are likely mismeasured, so we present these patterns in district-level savings rates as suggestive evidence for the persistence of the effects of migrant capital on long run labor market outcomes.

Figure 6 shows the raw relationship between the savings rate in 1968 (pre-shock) and the level of capital received by the district between 1966 and 1977. The right panel shows the same relationship for 1997/8, twenty years after the end of the migartion period. In the

pre-period, there is no relationship between the amount of capital a district will experience, and savings rates. In fact, savings are close to zero in most districts. Twenty years after the capital shock, there is a positive relationship between the size of that shock and district savings rates.

These figures do not control for any district-level variables. We estimate a difference-in-differences regression to look at the impact of the capital shock on savings rates at district level, controlling for district and year fixed effects and baseline district-level variables interacted with post dummies. The coefficient on the difference in differences term (the interaction between the size of the capital shock and a 1998 indicator variable) is 0.009 (with standard error 0.019 and p value 0.62; see additional results in the appendix). Our data are very noisy, making it difficult to estimate a precise impact for savings rates. However, combining these suggestive patterns from savings rates with the data on non-farm asset accumulation indicates that the way in which migrant capital had persistent impacts on rural labor markets was through enabling higher rates of accumulation over time.

7 Discussion

Because we condition on the total number of migrants in our empirical work, our results suggest that the size of the capital shock at district-level was important for shifting the types of work that people do in rural labor markets. An important question is whether we would have seen the same effects on the structure of employment if capital shocks were not migration-induced? For example, suppose that instead of an inflow of migrant capital inflows, districts received helicopter drops of cash, or foreign aid, or an increase in unconditional cash transfers for some share of the population. To make some headway on this question, we compare our results to evidence from two very different settings in which individuals experienced increases in access to capital at a local level, for reasons unrelated to migration.

Kaboski and Townsend (2012) and Kaboski and Townsend (2011) analyze the impact of an injection of microcredit funding into different districts in Thailand. The size of the transfer to villages of average size (between 25 and 250 households) was around USD24,000. An average transfer to households was between USD100 and USD1,000, which is similar to (perhaps a bit larger than) the capital returning to migrant households in Malawi. Using an instrumental variables approach, they identify larger positive impacts of the microcredit program on consumption than on credit and find some evidence of income growth derived from small businesses and labor income. Their results suggest that additional local credit allowed households to scale up production and increase revenues in household enterprises. The Thai case suggests that capital alone – without migrants – could make a difference to

market-level outcomes at least in the medium run (around 7 years), and that the mechanism for these impacts is local financial intermediation.

In a different study, Bandiera et al. (2016) analyzed the impacts of a randomized asset and skills transfer program to women in Bangladesh. Rates female labor force participation in this country are far lower than in Malawi. In this setting, a one-time transfer of livestock assets combined with skills training raised the share of women working at all and channeled this work into the most profitable agricultural jobs. The cost per household of this program was USD 1,100 (PPP dollars), which is similar to the upper tail of loans distributed in the Thai setting, but higher than average migrant capital received by migrant workers in Malawi. The paper documents continued asset accumulation, up to seven years after the end of the program. In this setting, the capital and skills intervention – again without migration – were important for shifting women into working in higher return activities, albeit still in farming. Relieving capital constraints in this way led to persistent changes in women's work.

Our results line up nicely with these results on the role of non-migrant-induced capital injections in changing the types of work that people do in local labor markets. While we cannot definitively answer the question "Would we expect to see the same sectoral shifts of labor over the long run if capital injections were not induced by migration?", it does seem that something about capital, separate from migrants, was important for generating our results.

We are able to separate our the effect of the number of migrants from the amount of capital in our empirical work. However, the spatial variation in capital that we exploit derives from differences in the timing of migration and the composition of miners. Could the composition of miners be an important factor accounting for the persistent effects of migrant capital on the structure of work in Malawi? We offer two reasons why this is unlikely to be the major explanation behind our results.

First, returning miners do not seem to be the ones entering the non-farm sector, at least immediately after the end of migration. In Appentix Table E2, we use 1977 Census data to show that the share of service sector workers is substantially lower in the ever-migrant male population, relative to the average shares in the population. Former migrants are instead much more likely to be farmers in 1977. These patterns are inconsistent with the idea that migrant workers (of any type) start up small businesses upon return, and also inconsistent with the idea that migrant workers may return home with more human capital relevant for the non-farm sector.[34]

Second, we might be concerned that repeat miners or miners leaving later in the period

[34]Mining related skills would not have been easily transferable to the farm or non-farm sectors of work in Malawi.

may return with a different set of preferences over farm and non-farm goods and services, and/or a different set of aspirations for the type of work they want to do. This change would have had to have been very large, and have spilled over to others in the district, as well as to future generations, in order to generate the changes in employment across sectors we measure that persist up to 2008. By 2008, very few of the economically active would have been mineworkers in the 1960s and 1970s. The effects we see in 1998 and in 2008 therefore represent changes in the structure of work for the next generation. It is difficult to imagine that the magnitude of our results could be accounted for by a change in returning migrant worker preferences alone.

8 Conclusion

This paper marshalls new historical data from Malawi to provide quasi-experimental evidence on the long run effects of migrant capital on the structure of rural labor markets. Exploiting two plausibly exogenous shocks to migration that expanded and then contracted the number of migrants, and generated a large inflow of capital to sending areas, we find that districts receiving more capital – conditional on the number of migrants – experience some measure of structural change over three decades. Employment shifts out of agriculture, and towards the service sector for both men and women. Jobs in construction, retail, general services, and transport and communications increase. Overall, employment becomes more diverse in those districts that received more capital from migration. Even after migration ended, accumulation persisted at higher rates. Districts with more migrant capital invested more in physical, non-farm capital and saved at higher rates over the long run, although the savings results are imprecisely estimated.

In addition to shedding light on a relatively unknown period in Malawi's economic history, our results are relevant to African labor markets in the past and present. Many southern African countries were affected by similar fluctuations in migrant labor flowing to the South African gold mines. Structural change could have occurred in these other countries too, as a result of capital accumulated from international labor migration. Given current demographic trends in Africa and little sign of industrial, agricultural, or trade revolutions to trigger structural change, it is possible that legal, time-limited migration may present one of the only practical ways to accumulate capital in labor-rich, resource-poor countries.

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Figure 1A: Industry of employment classifications for nonfarm sector

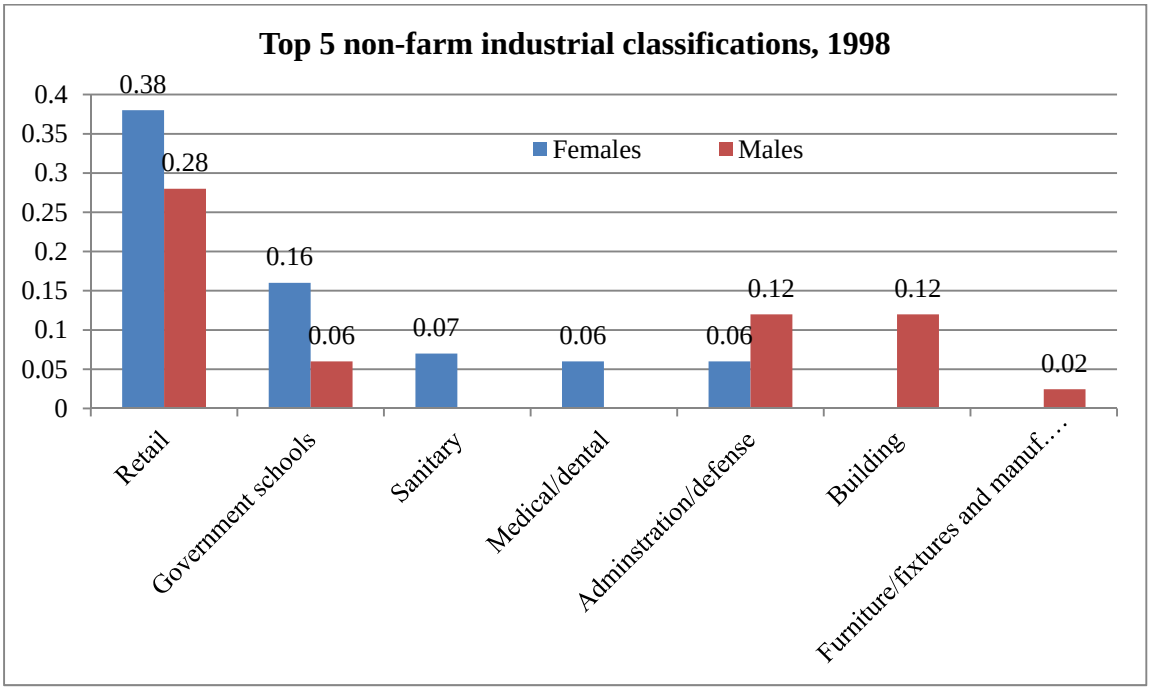
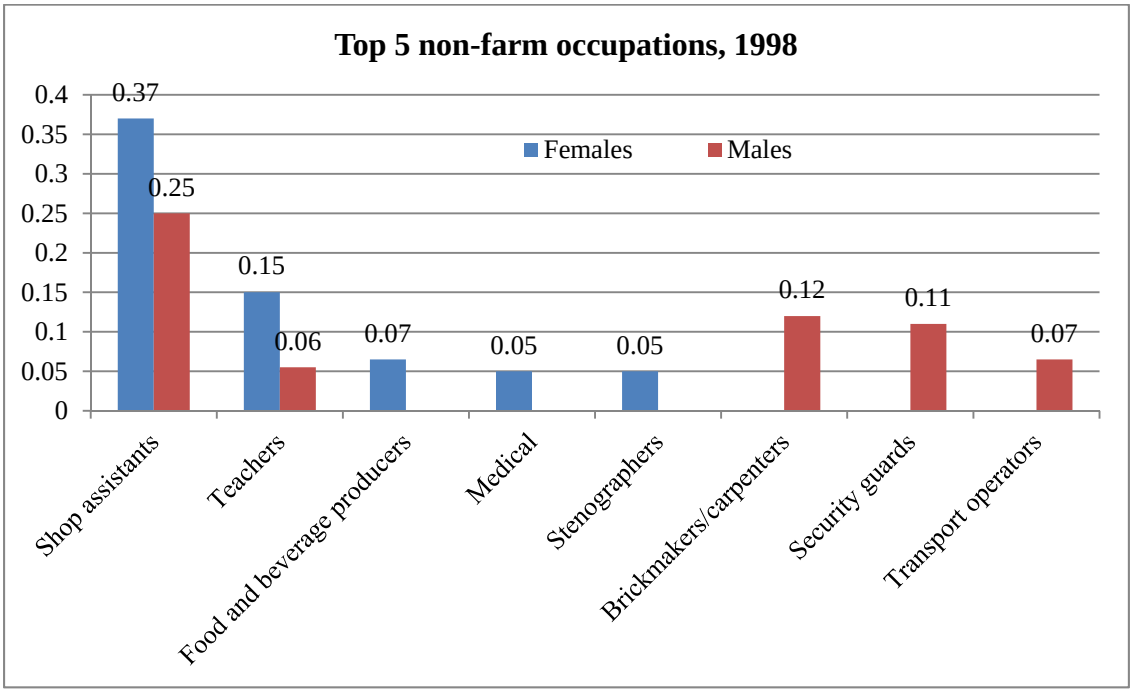
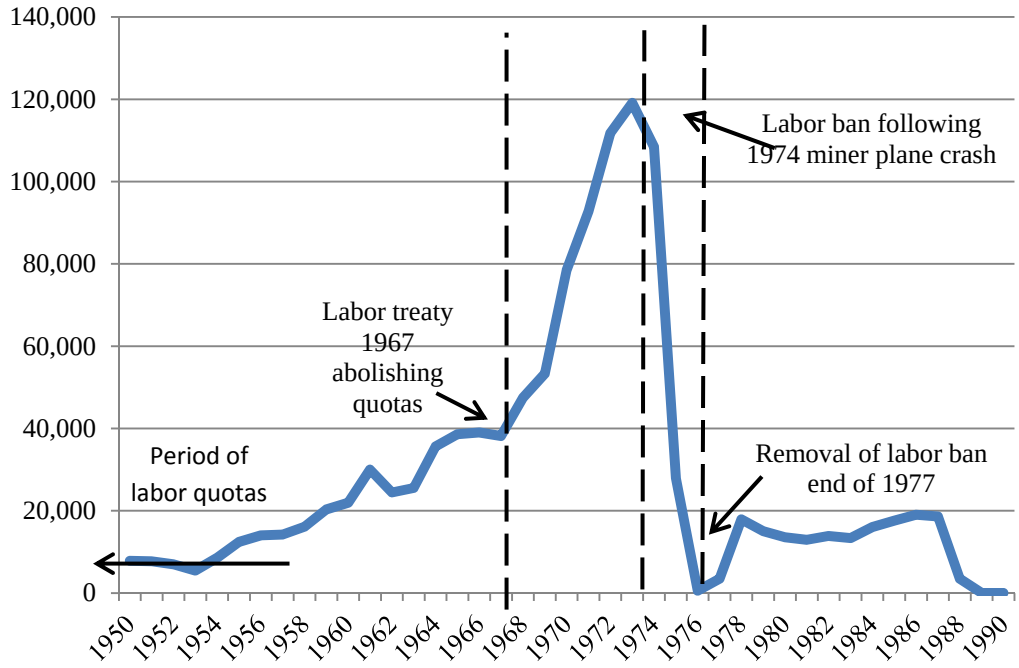


Figure 1A: Occupation classifications for nonfarm sector



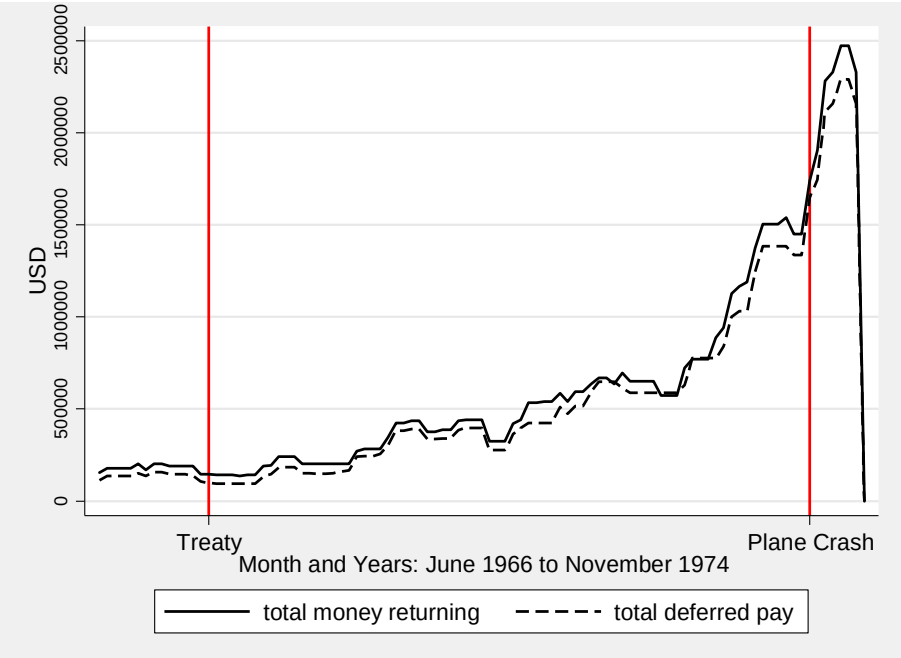
Notes: Figures indicate the share of men and women employed in non-farm industries (top figure) or non-farm occupations (bottom figure) using two digit industry and occupation classifications in the 1998 Census.

Figure 2A: Annual employment of Malawian miners on South African mines, 1950-1994



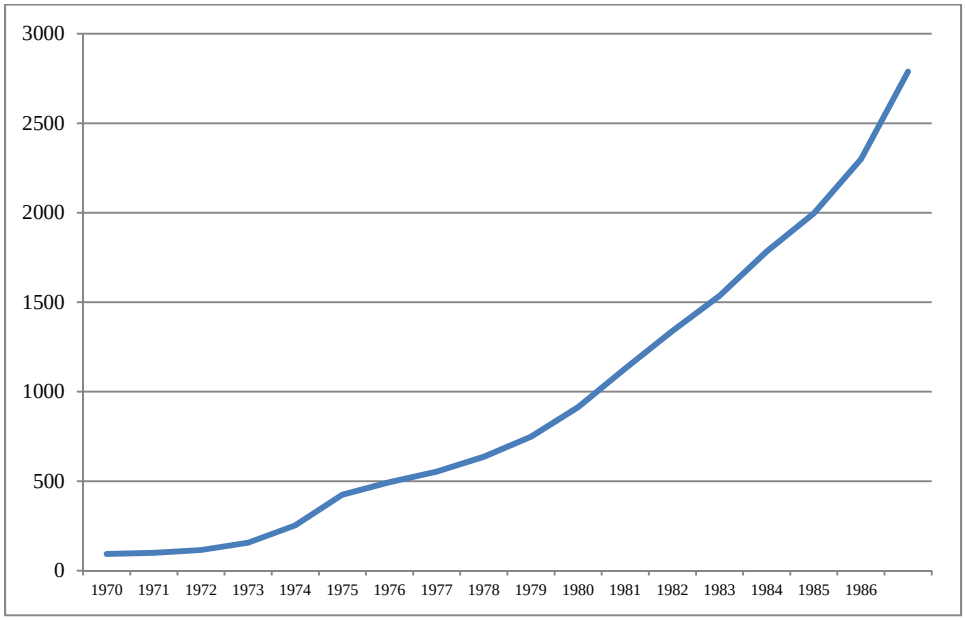
Source: Dinkelman and Mariotti (2016). Figure 2 shows number of workers contracted by Wenela to work on South African mines in each year. The three dotted lines represent (from left to right) the abolition of labor quotas in August 1967, the moratorium on migration after the April 1974 Malawian plane crash and the legal resumption of mine migration in 1978.

Figure 2B: Migrant capital flows over time, 1966-1975



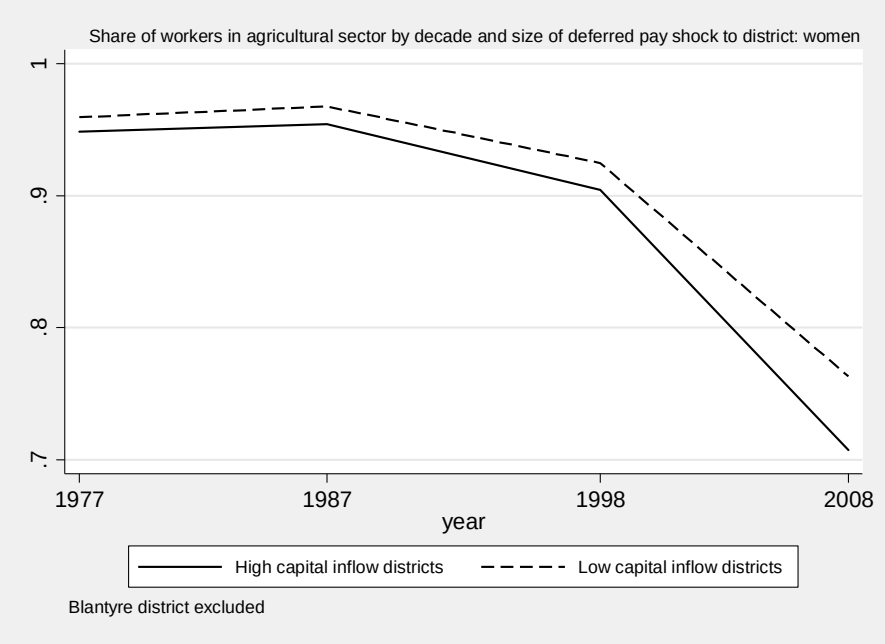
Source: Archival material collected by the authors

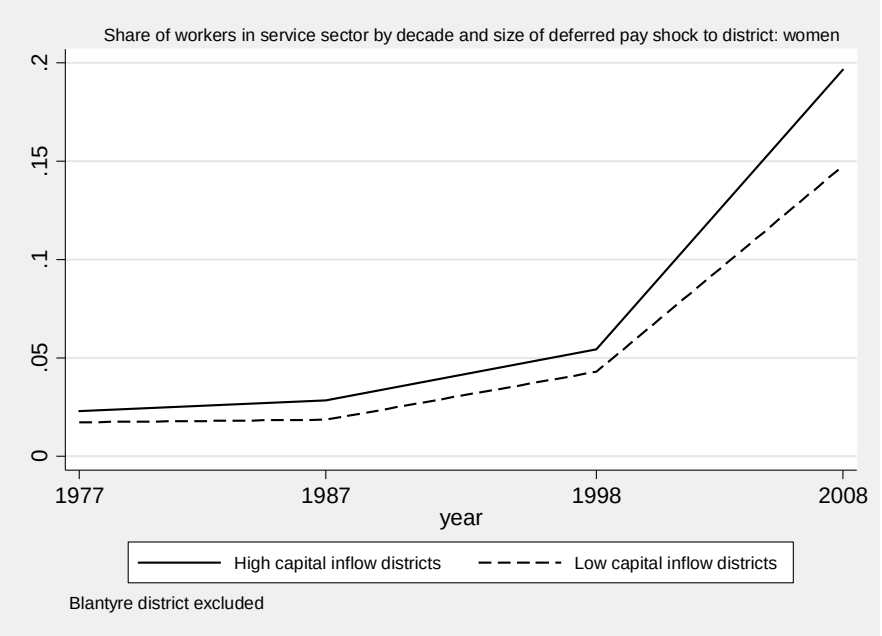
Figure 2C: Mineworker wages over time



Source: Crush et al (1991). Figure plots average miner wages paid to Chamber of Mine workers, in USD per year.

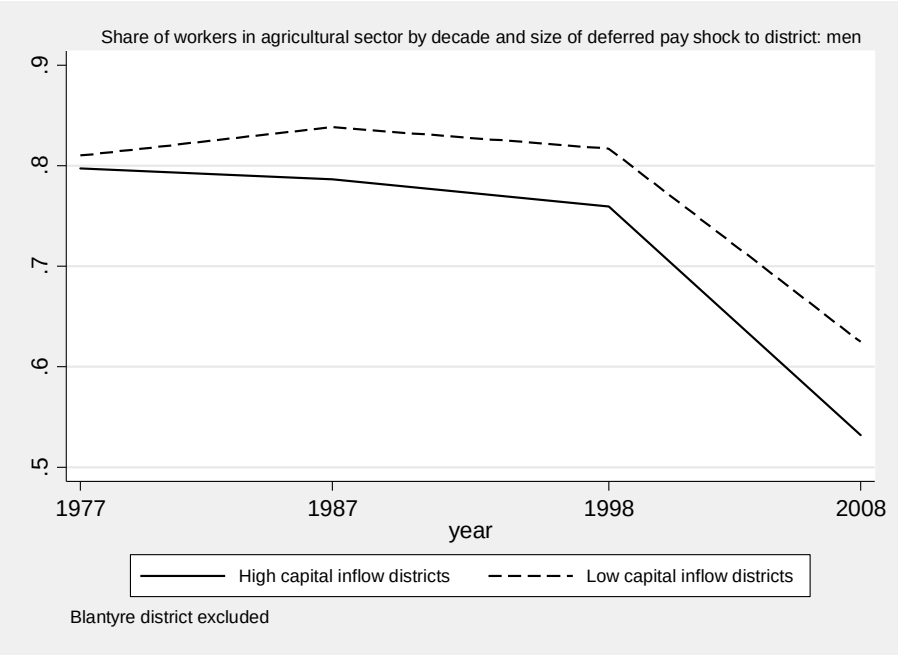
Figure 3: Sectoral shifts in the labor market: Women

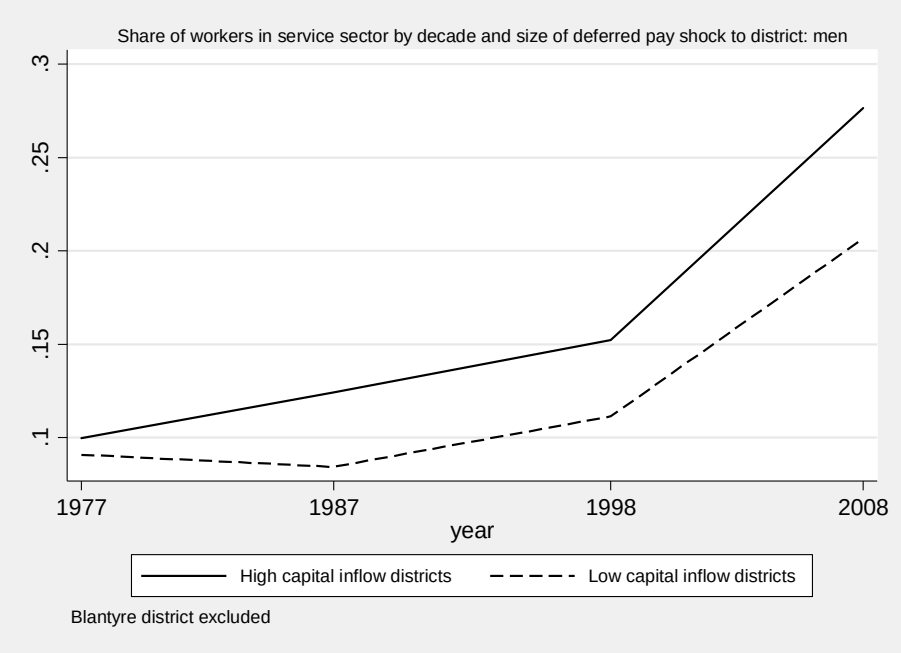




Notes: Share of employed women working in agricultural (top) or services (bottom) sectors over time and by type of district. High capital inflow districts are the districts receiving above median levels of migrant deferred pay before 1977.Low capital inflow districts are those receiving below median levels of deferred pay. Means are weighted using Census weights.

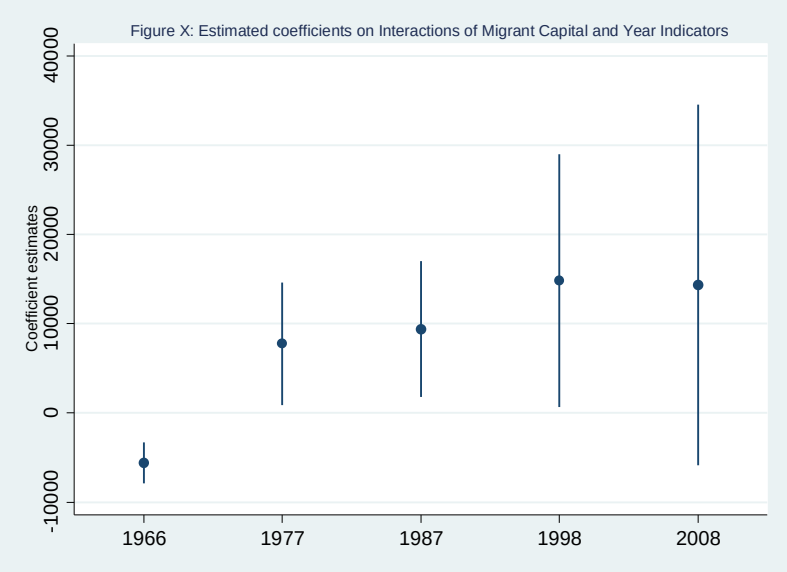
Figure 4: Sectoral shifts in the labor market: Men





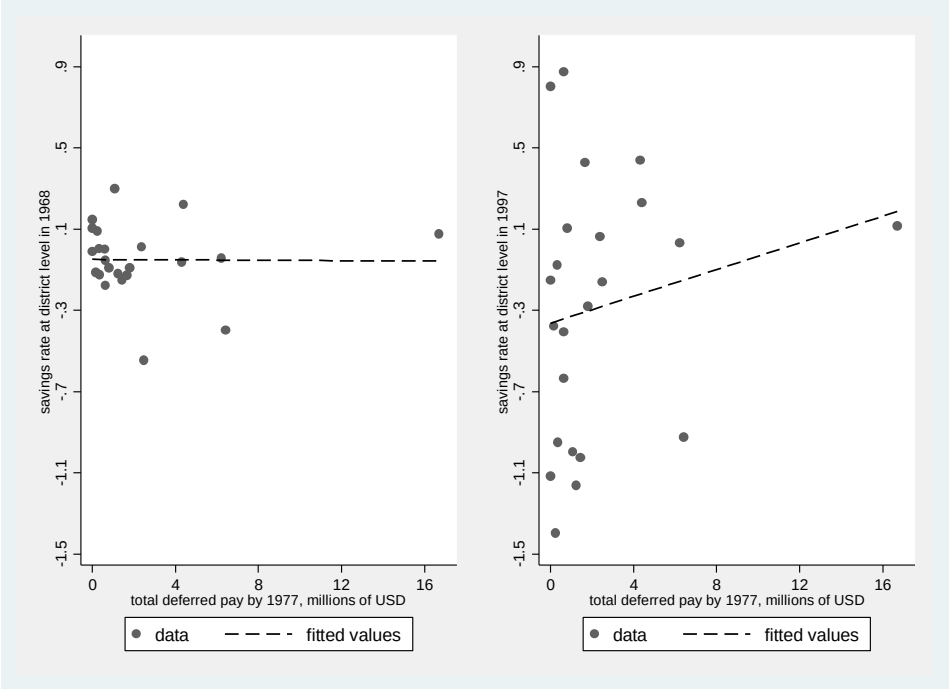
Notes: Share of male workers in agricultural (top) or services (bottom) sectors over time and by type of district. High capital inflow districts are the districts receiving above median levels of migrant deferred pay before 1977. Low capital inflow districts are those receiving below median levels of deferred pay. Means are weighted using Census weights.

Figure 5: Checking for pre-trends in population across high and low migrant capital districts



Notes: Figure plots coefficients estimated for equation (1) estimated using the total population of the district as outcome. The points are coefficients on the interaction of Census year dummies with the district-level migrant capital shock. Base year is 1945.

Figure 6: District-level savings rate versus size of migrant capital inflow, before and after migration episode



Notes: Left hand side panel shows correlation between district-level savings rate ((income-expenditure)/income) on y axis and migrant capital inflow on x axis in 1968. Right hand side panel shows the same correlation in 1998.

Table 1: Sector of work and economic activities, Malawi 1977 to 2008

	Employment shares by decade			
	1977	1987	1998	2008
Sector of work (Industry): Females				
Agriculture	0.943	0.941	0.888	0.695
Manufacturing	0.016	0.013	0.012	0.038
Services	0.028	0.037	0.067	0.210
Industrial concentration index	0.893	0.893	0.805	0.538
Sector of work (Industry): Males				
Agriculture	0.760	0.761	0.731	0.532
Manufacturing	0.093	0.077	0.074	0.133
Services	0.120	0.135	0.171	0.278
Industrial concentration index	0.618	0.622	0.589	0.357

Population-weighted shares of adults in each sector of work and employment category from Census data. *Panel A:* Information on the industrial ector of work for the economically active population (workers and unemployed) 10 years and older are collapsed to district-gender cells. 24 observations per cell. Home workers are excluded from these definitions. Industrial Concentration Index is a Herfindahl index of sector of work; larger values imply more concentration of work sector in the district. Data appendix contains details of dataset construction. Totals do not sum to 1 because of residual "not stated" categories for industry of work.

Table 2: Inputs used in farm and non-farm production in Malawi

Annual values, means in 1998 USD	**Working capital**	**Physical capital**	**Land capital**	**Total capital:**	**Revenue:**	**Effective Labor:**	**Value Added of Labor:**
Includes:	*Non-labor inputs excluding land and capital equipment*	*Equipment*	*In production*	*Working capital + physical capital + land*	*Sales + home production valued at market prices*	*Num. Workers*Share of year working*	*Net value added/Effective labor*
Households with farms N=9,280	20	13	125	158	97	0.44	403
Households with a non-farm business N=1,964	172	139	na/a	311	540	0.77	455
Ratio: Non-farm/farms	8.6	10.4		2.0	5.6	1.8	1.1

Data are from the 1997/1998 Malawi Household Integrated Income and Expenditure Survey (HIES). Unit of observation is the household, means are weighted, values (except for effective labor units) are annual means and standard deviations in USD. Statistics in the top panel are calculated over all rural households; in the bottom panel, the sample is restricted to rural households running at least one household business with only one worker (the majority of household businesses are single-operator). Working capital includes (e.g.) seeds and fertilizers, or stock for household retail businesses. Physical capital equipment includes (for example): hoes, sickles, pangas and axes for farming activities; bicycles and pounding mills for services. Land is only valued for farm operations. Annual revenues include the value of home produced goods and services. *Net value added measure excludes the value of land. See data appendix for further discussion of how measures of value added were created.

Table 3: Summary statistics for district-level data

	Mean	s.d.	min	max	N
Components of migration shock					
Number of adult men (aged 15-64) in the district in 1977	54,809	39,418	13,057	180,466	24
Number of adult men ever been abroad by 1977~	19,557	15,421	4,232	75,324	24
Δ number of migrants, 1966-1977	13,642	10,667	2,816	50,121	24
Total deferred pay per district 1966-1975, Millions of USD	2.25	3.53	0	16.29	24
Total deferred miner pay per person in district 1966-1977, USD	24.04	55.40	0	275.68	24
Total deferred miner pay per migrant from district 1966-1977, USD	129.41	177.76	0	908.46	24
District-level descriptives at baseline					
Northern Region	0.21	0.41	0	1	24
Central Region	0.38	0.49	0	1	24
Southern Region	0.42	0.50	0	1	24
Population, 1945	71,262	60,353	5,919	230,891	24
Population density, 1945	30.61	26.61	5.10	109.05	24
Share of youth literate in English and vernacular, 1945	0.08	0.04	0.03	0.14	24
Altitude: high malaria area=1	0.28	0.35	0	1	24
Share of districts with any agricultural estate	0.46	0.51	0	1	24
Share of men earning no cash income in 1966	0.37	0.10	0.22	0.59	24
Share of women earning no cash income in 1966	0.48	0.14	0.28	0.72	24

Data for the first set of outcomes are district-level data collected from administrative records and from Census 1977. Data for the second set of outcomes comes from 1945 Census data 1and from geographic files for Malawi. Agricultural estate is a dummy variable indicating whether a district contains any cash crop estates (e.g. for tobacco or sugar). Raw means (unweighted).

Table 4: Long run impacts of migrant capital on share of workers in different sectors

	Share in Agriculture		Share in Manufacturing		Share in Services		Industrial concentration	
Panel A: Women	*Mean: 0.88*		*Mean: 0.02*		*Mean: 0.08*		*Mean: 0.8*	
Millions of USD*Three decades post	-0.0157***	-0.00851***	0.00151**	0.00153*	0.0168***	0.00874***	-0.00663**	0.0026
	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)	(0.002)	(0.003)	(0.003)
Millions of USD*Two decades post	-0.0126***	-0.00874***	0.0007	0.0008	0.00922***	0.00366**	-0.0135***	-0.00962***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.004)	(0.003)
Millions of USD*One decade post	-0.00359*	-0.0011	0.0006	0.000908**	0.0027	-0.0008	-0.00538*	-0.00347**
	(0.002)	(0.001)	(0.000)	(0.000)	(0.002)	(0.001)	(0.003)	(0.002)
Thousands of migrants*Three decades post		-0.00121**		-0.0002		0.00171***		-0.0008
		(0.000)		(0.000)		(0.000)		(0.001)
Thousands of migrants*Two decades post		-0.00179**		-0.00002		0.00268***		-0.0017
		(0.001)		(0.000)		(0.001)		(0.001)
Thousands of migrants*One decade post		-0.00353***		-0.00001		0.00391***		-0.00459***
		(0.001)		(0.000)		(0.001)		(0.001)
P value for Joint F on Migrant capital	0.00	0.00	0.05	0.04	0.00	0.00	0.02	0.00
P value for Joint F on Number of migrants		0.00		0.56		0.00		0.00
Panel B: Men	*Mean: 0.73*		*Mean: 0.09*		*Mean: 0.15*		*Mean: 0.58*	
Millions of USD*Three decades post	-0.00590**	-0.00055	0.0000	-0.0002	0.00784***	0.0015	0.0016	0.0011
	(0.003)	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.004)	(0.005)
Millions of USD*Two decades post	-0.0116***	-0.00745***	0.0019	0.0011	0.01000***	0.00575***	-0.0105***	-0.00914**
	(0.003)	(0.003)	(0.001)	(0.002)	(0.002)	(0.001)	(0.003)	(0.004)
Millions of USD*One decade post	-0.00665***	-0.00446***	0.0004	0.00035	0.00380**	0.0010	-0.00854***	-0.00780***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Thousands of migrants*Three decades post		-0.00128**		-0.00001		0.00171***		-0.0007
		(0.001)		(0.000)		(0.000)		(0.001)
Thousands of migrants*Two decades post		-0.00236**		0.0007		0.00232***		-0.0013
		(0.001)		(0.001)		(0.001)		(0.001)
Thousands of migrants*One decade post		-0.00285***		0.0001		0.00342***		0.0001
		(0.001)		(0.001)		(0.001)		(0.001)
P value for Joint F on Migrant capital	0.00	0.00	0.23	0.45	0.00	0.00	0.00	0.00
P value for Joint F on Number of migrants		0.04		0.56		0.00		0.35

Standard errors clustered at district level. Significance levels ***p<0.01, **p<0.05, *p<0.1 where critical values are taken from the small sample *t*-distribution. Migrant capital is the total deferred pay returning to each district by 1975, in millions of USD. Data are from Census 1977, 1987 (one decade post), 1998 (two decades post) and 2008 (three decades post). Unit of observation is the district-gender cell. Total districts=24. Total observations in each regression is 96. All regressions include district and year fixed effects and interactions of a linear trend term with baseline variables (adult literacy in 1945, population density in 1945, a malaria dummy, share of men and women married in 1966, share of men and women not earning any cash income in 1966, two region dummies). Industrial concentration is a Herfindahl index measuring how concentrated work is in any one sector. Regressions are population weighted.

Table 5: Long run impacts of migrant capital and workers on share of employment in each non-farm subcategory

	General manufacturing	Construction	General services	Retail	Transport or communications
Panel A: Women	*Mean: 0.0139*	*Mean: 0.005*	*Mean: 0.0288*	*Mean: 0.0463*	*Mean: 0.0011*
Millions of USD*Three decades post	0.0004	0.00107***	0.00189**	0.00676***	0.0001***
	(0.001)	(0.000)	(0.001)	(0.002)	(0.000)
Millions of USD*Two decades post	0.00009	0.000693**	0.0004	0.00316***	0.0001***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Millions of USD*One decade post	0.0004	0.000481**	-0.00014	-0.0008	0.0002***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Thousands of migrants*Three decades post	-0.0001	-0.00004	0.000913***	0.000782***	0.00001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Thousands of migrants*Two decades post	0.0000	-0.00005	0.00166***	0.000956**	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Thousands of migrants*One decade post	0.0001	-0.00015	0.00188***	0.00195***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
P value for Joint F on Migrant money	0.13	0.04	0.00	0.00	0.00
P value for Joint F on Number of migrants	0.09	0.42	0.00	0.00	0.00
Panel B: Men	*Mean: 0.049*	*Mean: 0.036*	*Mean: 0.074*	*Mean: 0.065*	*Mean: 0.013*
Millions of USD*Three decades post	-0.00374*	0.00379***	-0.00269***	0.00563***	-0.00143***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)
Millions of USD*Two decades post	-0.00425***	0.00547***	0.0005	0.00693***	-0.00171***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Millions of USD*One decade post	-0.00192**	0.00216***	-0.0003	0.00156***	-0.0003
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Thousands of migrants*Three decades post	0.0006	-0.000584***	0.00135***	0.0001	0.000224**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Thousands of migrants*Two decades post	0.00153***	-0.000947***	0.00149***	0.0002	0.000638***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Thousands of migrants*One decade post	0.00106**	-0.00108***	0.00161***	0.00119***	0.000615***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
P value for Joint F on Migrant money	0.00	0.00	0.00	0.00	0.00
P value for Joint F on Number of migrants	0.01	0.01	0.00	0.00	0.00

Standard errors clustered at district level. Significance levels ***p<0.01, **p<0.05, *p<0.1 where critical values are taken from the small sample t-distribution. Migrant money is the total deferred pay returning to each district by 1975, in millions of USD. Data are from Census 1977, 1987, 1998 and 2008. Unit of observation is the district-gender cell. Total districts=24. Total observations in each regression is 96. All regressions include district and year fixed effects and interactions of a linear trend term with baseline variables (adult literacy in 1945, population density in 1945, a malaria dummy, share of men and women married in 1966, share of men and women not earning any cash income in 1966, two region dummies).

Table 6: Testing pre-trends and checking impacts on population growth and urbanization

	Ln population	Ln female population	Ln population under age 5	Ln population age 5 to 18	Ln population age 18 +	Share of urban population
Millions of USD*Three decades after	0.0425*	0.0334	0.046	0.024	0.031	0.00591**
	(0.023)	(0.021)	(0.030)	(0.029)	(0.028)	(0.003)
Millions of USD*Two decades after	0.0436*	0.0339*	0.044	0.029	0.032	0.00630**
	(0.022)	(0.019)	(0.030)	(0.027)	(0.026)	(0.003)
Millions of USD*One decade after	0.0343**	0.0237*	0.0432**	0.027	0.027	0.00464***
	(0.017)	(0.013)	(0.020)	(0.018)	(0.019)	(0.002)
Millions of USD*End of migration	0.0286**	0.0185	0.0415**	0.022	0.024	0.00408***
	(0.013)	(0.011)	(0.017)	(0.016)	(0.016)	(0.001)
Millions of USD*One decade before	-0.0292***	-0.0398***	-0.015	-0.0324**	-0.0294***	
	(0.004)	(0.004)	(0.009)	(0.012)	(0.010)	
N	144	144	144	144	144	120
R2	0.96	0.97	0.96	0.97	0.97	0.92
Mean	12.04	11.37	10.59	11.20	11.45	0.04
P value for Joint F on migrant capital interactions	0.30	0.10	0.02	0.26	0.65	0.00
P value for Joint F on migrant interactions	0.13	0.07	0.72	0.88	0.14	0.02

Standard errors clustered at the district level. Significance levels ***p<0.01, **p<0.05, *p<0.1 where critical values are taken from the small sample t-distribution. Census data are from 1945, 1966, 1977, 1987, 1998 and 2008. Omitted category is Millions of USD*(Year=1945) for the first three outcomes; Millions of USD*(Year=1966) for the last outcome. Unit of observation is the district-year cell. Total districts=24. All regressions control for district and year fixed effects, interactions of baseline controls with year dummies, and interactions of number of migrants with year dummies. Regressions are not population-weighted. Urban share of the district not available in 1945.

Table 7: Differential trends in internal migration across districts with varying capital shocks

	Inmigration rate per 1,000:		**Outmigration rate per 1,000:**		**Net migration rate per 1,000:**	
Definition	*Num inmigrants/current population*1000*		*Num. outmigrants/current population*1000*		*((Num. inmigrants-Num. outmigrants/total current population)*1,000*	
	Mean: 275		*Mean: 278*		*Mean: -3*	
Millions of USD*Year=2008	-18.52	-16.09	42.50	26.13	-61.02	-42.22
	(15.21)	(18.46)	(59.46)	(49.78)	(54.77)	(43.83)
Millions of USD*Year=1987	-16.45	-19.34	79.72	87.36	-96.18	-106.70
	(18.10)	(30.05)	(85.84)	(109.30)	(79.60)	(93.70)
Millions of USD*Year=1997	-13.35	-23.27	120.10	148.50	-133.40	-171.70
	(25.04)	(43.66)	(120.90)	(167.00)	(112.80)	(143.40)
Controls for number of migrants*Year	N	Y	N	Y	N	Y
N	91	91	91	71	71	71

Standard errors clustered at the district level. Significance levels ***p<0.01, **p<0.05, *p<0.1 where critical values are taken from the small sample *t*-distribution. Data are from 1966, 1977, 1987 and 2008 Census. Unit of observation is the district-year, migration rates are computed for people of all ages in the district. All regressions control for district and year fixed effects, and for a trend term interacted with district controls: baseline adult literacy in 1945, population density in 1945, a malaria dummy, an agricultural estate dummy, the share of men and women not earning cash wages in 1966, and two region dummies. In the second column for each outcome, these district controls also include the number of migrants leaving between 1966 and 1977 interacted with trend. Regressions are not weighted.

Table 8: Long term impacts of migrant capital on investments in physical capital

Share of households with (number of*)	**Hoe***	**Panga***	**Any Cattle**	**Bicycle**	**Oxcart**
	Mean: 1.82	*Mean: 0.48*	*Mean: 0.1*	*Mean: 0.37*	*Mean: 0.02*
Millions of USD*Three decades post (Year=2008)				-0.00447***	-0.008
				(0.002)	(0.009)
Millions of USD*Two decades post (Year=1998)	-0.010	0.006	0.007	0.000	-0.002
	(0.021)	(0.006)	(0.007)	(0.002)	(0.006)
Base year	1968	1968	1968	1987	1987
Years of data in sample	1968, 1997	1968, 1997	1968, 1997	1987, 1998, 2008	1987, 1998, 2008
N	46	46	46	69	69
P value of joint test on Migrant capital	n/a	n/a	n/a	0.20	0.08

Share of households with	**Durable walls**	**Durable roof**	**Durable roof and walls**	**Radio**	**Piped water**
	Mean: 0.39	*Mean: 0.13*	*Mean: 0.12*	*Mean: 0.28*	*Mean: 0.17*
Millions of USD*Three decades post (Year=2008)	-0.010	0.006	0.007	-0.00447***	-0.008
	(0.021)	(0.006)	(0.007)	(0.002)	(0.009)
Millions of USD*Two decades post (Year=1998)				-0.0004	-0.002
				(0.002)	(0.006)
Millions of USD*One decade post (Year=1987)	0.011	0.0136***	0.0134***	0.001	-0.002
	(0.012)	(0.003)	(0.004)	(0.001)	(0.004)
Millions of USD*Post (Year=1977)				0.00145*	
				(0.001)	
Base year	1968	1968	1968	1968	1977
Years of data in sample	1969, 1987, 2008	1969, 1987, 2008	1969, 1987, 2008	1969, 1977, 1987, 1998, 2008	1977, 1987, 1998, 2008
N	69	69	69	115	92
P value of joint test on Migrant capital	0.01	0.00	0.00	0.000	0.086

Standard errors clustered at the district level. Significance levels ***p<0.01, **p<0.05, *p<0.1 where critical values are taken from the small sample *t*-distribution. Data are from different Census years for each outcome. Outcomes in Panel A: *Share of households with a bike, oxcart, or any cattle, and mean number of hoes and pangas per household in the district. Unit of observation is the district-year cell. Total districts with data in all Census years including 1966: 23. Other controls includes interactions of survey year dummies with total migrants between 1966 and 1977 and baseline district variables: adult literacy in 1945, population density in 1945, a malaria dummy, the share of men and women married in 1966, the share of men and women not earning any cash income in 1966, and region dummies. All regressions contain district fixed effects and year dummies. Regressions are not weighted.

A Data Appendix

This appendix describes the data sources we used to construct the analysis datasets used in Dinkelman, Kumchulesi and Mariotti (2016) "Labor migration, capital accumulation, and the structure of rural labor markets"'.

A.1 Census data

Our main datasets are constructed from Census data collected in 1977, 1987, 1998 and 2008. The 1977 Census data were digitized from aggregate Census reports. The 100% microdata from the 1998 Census was obtained from the Malawi National Statistics Office. IPUMSI (`https://international.ipums.org/international/`) provides provides access to the 10% sample for 1998. The 1987 and 2008 Census data are 10% samples from the IPUMSI repository.

We also use data for some outcomes from earlier Census data in 1966, 1945 and 1931. We digitized all relevant tables from aggregate Census reports in these years (**?**) (**?**) (**?**).

A.1.1 District boundary crosswalk: 1931 to 2008

We created a district boundary crosswalk that links district boundaries over time, through name changes and boundary changes. We use the districts existing in 1977 as the sample of districts. We consolidated information in variables from districts that had split in later years into their origin districts in 1977. For districts in earlier years that had split by the late 1970s, we apportioned the earlier cell totals to 1977 district boundaries using area weights.

A.2 Labor market outcomes

We create three categories of labor market variables: broad sector of work variables, narrow sector of work variables, and economic activity status variables.

Broad sector of work: We define work in the agriculture, manufacturing, or service sector for each Census, using the number of people who are currently economically active (those employed and currently unemployed) in the denominator. Houseworkers and other inactive people (students, pensioners, other dependents) are excluded from both numerator and denominator of these variables. In each year, a small share of those in the labor force do not report an industry (most of these are unemployed people who have not worked before), so shares across the three broad sectors do not sum to one. For a more detailed definition of sector of work within the nonfarm sector, we disaggregate all non-agricultural employment into mining, manufacturing, retail, transport and communications, and all other services (business services, household services, and other non-specified services).

To create a summary measure of employment diversity in the district, we construct a Herfindahl index for (broad) industrial sector of work. The smaller the value of this index, the more evenly people are distributed across sectors. The larger the value of this index, the

more people are concentrated within one of the three sectors.

Economic activity variables We define these variables for the sample that includes everyone in the relevant age group in a given district:

- In the labor force: working, unemployed, or doing home production
- Working: working or doing home production
- Subsistence: working as mlimi (subsistence farmer) or doing home production
- Family business worker: working in a non-farm family business
- Self-employed: working in a non-farm business for themselves
- Wage worker: working for someone else for a wage or salary
- Employer: employs other workers in a business

Economic activity variables and sector of work variables differ because the economic activity variables capture activity shares in the entire population, not just those in the labor force. Home production workers (mostly women) are excluded from sector of work variables but included in the economic activity variables. Our data show that the majority of family business workers, self-employed, wage workers and employers work in the non-farm sector.

In Tables A1 and A2 on page 40, we compare the wording of Census questions across years. For the most part, it is possible to create a consistent set of definitions of each of the above variables, using combinations of different Census questions.

In 1977, 1987 and 1998 (and all prior Census years), the Census was conducted in September or October which is at the start of planting in the new agricultural season. The 2008 Census deviated from this pattern and was conducted in June, which is at the start of the dry season, between harvest and planting for the next agricultural season. This means that overall (in all districts and for all age groups), agricultural employment is lower relative to employment measured in the planting seasons, September and October. Dinkelman and Kumchulesi (2016) discuss the implications of this change in timing of the Census on employment outcomes in the face of seasonality in labor requirements. In the current paper, the level effect of this change in timing of the Census are accounted for by a year fixed effect for 2008. We also show our main results are robust to excluding the 2008 data.

Table A1: **Occupation and Industry Questions in Malawi National Census**

Census 1977	**Census 1987**	**Census 1998**	**Census 2008**
Sample: 10 years + answering yes to Qn. O	Sample: 10 years +, not inactive	Sample: 10 years and male, or female and not inactive (If inactive person is female, do not ask B18 and B19)	Sample: 10 years +, and ever worked (currently, or before) and currently available to work
Q: What is your occupation?	N: What is your occupation?	B18: What is this person's main occupation?	P25. What was [the respondent's] main occupation during the last 7 days or the last time he/she worked? P26. What is [the respondent's] status in the occupation? (Employer, self employed, public sector, private sector, family farm/business, other)
R: What is your industry of work?	O: What is your industry of work?	B19: What is this person's main trade or business (industry)?	P27. What is the main product, service or activity of [the respondent's] place of work?

A.3 Population density and urbanization variables

We digitized population data from the 1945, and 1966 Nyalasand Census and the 1977 Malawi Census. These data were reported at district level, sometimes separately for men and women in different age groups. We combined these data with district data from the 1987, 1998 and 2008 Census, and constructed poopulation densities at district level using the area of the district. We also measure population totals over, for men and women separately, and the share of population in urban areas within the district.

A.4 Migrants at district-level

In Census 1977, the total number of men who report ever migrating from Malawi is reported at district level (Census 1977, Table 4.8) while the share of miners who returned between 1966 and 1977 is reported in national aggregate data (Census 1977, Table 4.11). To construct district-specific numbers of migrants returning between 1966 and 1977, we multiplied the share of workers who had returned to Malawi in the last 10 years (out of all ever migrants who returned to Malawi) by the total men in each district who had ever migrated for work by 1977. Because of the labor ban, all migrants had returned to Malawi by 1975 and so would have been present in the 1977 Census.

Figure 1 is constructed using national labor migration totals from a variety of sources including: Chirwa (1992) for years 1950-1958; Lipton (1980) for years 1959-1994; Crush, Jeeves and Yudelman (1991) and various years of TEBA (The Employment Bureau of Africa) Annual Reports for the remainder.

A.5 Baseline district covariates from Census data

Historical literacy rates: we digitized data on the district-specific share of adults who were literate from the Report on the Census of 1931 (Nyasaland Protectorate, Table 6)

Share of married men and women in 1977: we digitized data on the share of men and women married from Census 1977 (Table 2.1)

Share of men and women with no cash incomes in 1966: we digitized the district-specific rates of men and women earning no cash income from the Malawi 1966 Population Census Final Report (Malawi National Statistics Office, Zomba: Table 21)

A.6 Physical and human capital investments and asset ownership

We measured investments in different ways, based on what information was available in at least two datasets. We used data from the 1977, 1987, 1998 and 2008 Census data as described above, and from the 1968/9 National Sample Survey of Agriculture (NSSA). The NSSA data were collected from around 5,000 households, and was designed to be representative at district-level. The part of the 1968 survey that collected these data was an income and expenditure-type survey.

Table A2: **Economic Activity Status Questions in Malawi National Census**

Census 1977	Census 1987	Census 1998	Census 2008
Sample: 10 years and older	Sample: 10 years and over	Sample: 10 years and over	Sample: Non-visitors, 6 years and over
O: Did you work last week (Y/N)?	M: Activity status in last seven days? Active: Mlimi, Employee, Family business worker, Self employed, Employer, Unemployed (Worked before and seeking/not seeking work, or never worked and seeking/not seeking work). Inactive: Home worker, Student, Dependent, Independent, Other	B17: What was X doing in the last 7 days? Active: Mlimi, Employee, Family business worker, Self-employed, Employer, Unemployed (worked before, seeking/not seeking work, never worked before/seeking work). Inactive: Non-worker: never worked before and not seeking work, homeworker, student, other	P20. Aside from his/her own housework, did X work during the last 7 days? (Y/N)
			P21. Why did X not work during the last 7 days? Inactive: Homeworker, Non-worker (never worked), On leave with job, Retired, Student, Other
P: What was your activity? Active: Mlimi, Employee, Family business worker, Self-employed, Employer, Unemployed (worked before and seeking/not seeking work; never worked before and seeking/not seeking work). Inactive: Home worker, student, dependent, independent, other			P22. Did X do one of the following activities during the last 7 days? Active: Farming/rearing animals/fishing, Production/services/selling, House worker at someone's house, Homeworker at own house, nothing
			P23. Is S available to work? (Y/N) P24. Has X been seeking work during the last 7 days? (N, Y-first job, Y-new job)

Radios: The share of households in the district owning at least one radio exists in all years.

Piped water: The share of households in the district with piped water/indoor plumbing was available in all years except the 1968 data.

Bike ownership: The share of households with at least one bike was available in 1968, 1987, 1998 and 2008.

Durable housing: The share of households that lived in houses with a durable wall, durable roof, or both durable wall and roof was available in 1968 and in 1987.

Agricultural tools: The share of households with at least one panga, at least one hoe, or at least one type of livestock.

B Administrative data

To measure flows of migrant capital, and describe the composition of miners, we collected and digitized data from the National Archives in Malawi and from The Employment Bureau of Africa (TEBA) archives in South Africa, from the Malawian National archives and Rhodes House Library at Oxford University in the U.K.

Migrant capital: Our data record the monthly flows of migrant money from South Africa to specific districts in Malawi, for the period October 1966 to November 1975. These records come from documents entitled "Attestation and Despatch Returns to the Ministry of Labour", found in Malawi's National Archives in Zomba and in the TEBA Archives at the University of Johannesburg, South Africa. To construct a time series of the flows in a consistent currency unit, we converted GBP to the Malawi Kwacha using an exchange rate of 2:1, the official exchange rate at the time the Malawi currency was adopted in 1971. Capital flows were recorded in each of three categories: deferred pay, voluntary remittances, and deposits. Our analysis uses only the deferred pay amounts that were set by contract. These flows make up 89% of the total flows of money over the period.

C Other Geographic covariates

Area: geographic area for 24 districts was calculated in ArcGIS

High Malaria Area indicator: we computed altitude for each point on the Malawian grid map using data from the national map seamless server `http://seamless.usgs.gov/index.php` and the Viewshed tool in ArcGIS. We aggregated these measures to district level. Then we defined areas of high, medium or low malaria susceptibility based on standard measures of altitude: high malaria areas (altitude below 650m), medium malaria areas (altitudes be-

tween 650m and 1100m) and low malaria areas (altitudes over 1100m)

Estate indicator: We identified which districts contained a large tea or tobacco plantation using information in Christiansen (1984). The FAO's crop suitability index measuring whether a district is highly suitable for tobacco or tea production significantly predicts this estate district indicator

D Household Income and Expenditure Surveys

We used micro-level data from the Malawi Integrated Household Income and Expenditure Survey 1997/1998 to characterize the capital intensity of farm and non-farm activities in Malawi and to create a measure of agricultural productivity (value-added of labor in agriculture; see Gollin et al 2013 for detailed description of this measure).

To measure value added in agriculture, we computed the total value of self-employment output in agriculture, the value of labor income from agricultural work outside of the household and any interest on land rented out. For self-employment output on farms, we valued all crops produced at home, whether for market or home consumption. We valued home produced goods at local or national market prices, whichever was available for the specific crop and unit harvested. We do the same for livestock sold. From this agricultural income total at the household level, we subtracted out the value of non-labor inputs (rented land, fertilizer, seeds) and hired-in labor inputs into agricultural production.

To measure value added in non-farm activities at the household level, we added revenues from non-agricultural household businesses, wage and salary income from non-farm work outside of the home, and subtracted out the costs of intermediate inputs used in self-employment. Almost no households report renting out capital equipment for non-farm use.

Measuring labor used in each sector is tricky, mainly because workers do not have full-time jobs in either sector. We computed effective units of labor used in agriculture, and in non-farm work at household level, by counting up the number of workers reporting their primary occupation is in agriculture as a farmer, or not, and weighting these workers by the average number of weeks worked in the last year. We also included women reporting home production as farm workers in the household. Following the macro literature, we included measures of workers who are currently unemployed but who report sector of work and weeks of work per year.

To create value added of labor measures, we divided household value added in each sector by the total number of workers in the household in each sector.

E Robustness Appendix

Table E1: **Effect of capital shock on district-level savings rates**

	Savings rate	**Savings rate**
Millions of USD*Post	0.039	0.009
	(0.036)	(0.019)
Thousands of migrants*Post		0.0165
		(0.014)
N	46	46
R2	0.70	0.73
Mean of Y	-0.17	-0.17

Standard errors clustered at the district level. Significance levels ***p¡0.01, **p¡0.05, *p¡0.1 where critical values are taken from the small sample t-distribution. Savings rates are computed for each district in 1968 (before) and 1998 (after). All regressions contain district fixed effects and a post dummy. Regressions are not weighted.

Table E2: **Sector of work for all men and for ever migrant men in 1977**

Sector	**All men**	**Ever migrant men**	**Ratio of shares**
Farming, hunting, forestry, fishing	0.760	0.824	1.085
Mining, quarrying	0.002	0.003	1.561
Manufacturing	0.055	0.047	0.850
Electricity, gas, water	0.003	0.002	0.669
Construction	0.037	0.028	0.774
Wholesale, retail, restaurant. hotel	0.041	0.037	0.918
Transport, storage and communication	0.018	0.012	0.661
Business services (finance, insurance etc)	0.003	0.001	0.449
Community, social, personal services	0.055	0.036	0.652
Not stated	0.027	0.009	0.351

Table shows shares of all working age men (15 years and older) and shares of ever migrant working age men working in different industries. Source: Census 1977 aggregate reports, Tables 4.6 and 4.10