The Role of Labour Market Frictions
in Structural Transformation[*]

Kevin Donovan

Yale School of Management

Todd Schoellman

Federal Reserve Bank of Minneapolis

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Abstract

Growth is closely related to structural transformation, the reallocation of economic activity among sectors. A well-functioning labour market plays an important role in this process by enabling workers to find employment in the growing, higher-paying sectors, while a frictional labour market slows structural transformation and traps workers in poverty. We review the literature on the extent of labour market frictions and their role in slowing structural transformation in developing countries. The three main areas of focus are wage gaps and worker selection, the dynamism of labour markets, and specific labour market barriers. Evidence in each area points to the presence of frictions that hinder labour reallocation. The literature also suggests policies that may help remedy frictions and improve worker mobility. We conclude by noting several open questions that provide promising avenues for future work.

1   Introduction

It has been well understood since at least Kuznets (1973) that the transition to modern economic growth requires a structural transformation of the economy among sectors, from agriculture to manufacturing and then services. The need for a well-functioning labour market to enable the necessary movement of workers has been recognised for at least as long (Lewis, 1954; Harris and Todaro, 1970). Yet there is a persistent concern among policymakers that poor country labour markets are failing to create the jobs needed to support structural transformation and growth (e.g. World Bank, 2013).

A recent literature provides evidence that supports this concern by carefully documenting large gaps in outcomes such as labour productivity or wages among sectors in developing countries. The literature also works to identify the extent to which these gaps constitute a misallocation of labour among sectors of the economy. Finally, the literature documents specific frictions that prevent workers from moving to the more productive, higher-paying sectors and seeks to understand how these frictions might be remedied. The goal of this paper is to review the current state of this literature as well as to highlight profitable avenues for future research.

We start by reviewing the evidence on gaps in labour productivity among sectors. Large sectoral productivity gaps are pervasive, particularly in developing countries. This finding by itself suggests (but does not quite show) that the allocation of labour is inefficient. We then discuss the literature on labour market frictions, dividing it into three main areas.

First, we show that large productivity gaps manifest as equally large gaps in the outcomes that workers experience, such as wages or consumption. We then use a simple Roy (1951) model to frame a discussion about whether these differences reflect opportunities for workers to raise their incomes or selection of heterogeneous workers among sectors. We highlight three approaches the literature has used to address this question. Each approach suggests that at least part of the gap is likely due to frictions in labour markets.

Second, we review the literature on labour market dynamics in developing countries. We start with the evidence on gross labour market flows, which are often used as an indicator of the fluidity of a labour market. Developing countries have higher labour market flows, but these flows appear to be driven by churn among non-employment, subsistence self-employment, and low-wage work. There is little evidence that these flows help workers move to or persist in

higher-paying jobs. The fact that workers reallocate more frequently among these unproductive jobs suggests that they face barriers to achieving stable, high-wage work.

We then proceed to the literature on the net reallocation of labour among sectors. A consistent finding in this literature is that new cohorts of workers account for a disproportionate share of the net reallocation of labour. For example, more than half of the transition from agriculture to non-agriculture is accounted for by new cohorts of workers entering the labour market in non-agricultural jobs while older cohorts of workers retire from agricultural work. The literature has typically viewed this finding as evidence that either a lack of human capital or other barriers limit the ability of existing workers to take advantage of opportunities in growing sectors.

Third, we consider the rich literature that investigates particular frictions that limit the reallocation of labour across sectors. A substantial empirical literature documents the importance of mechanisms such as monopsony power of firms, transportation costs, or limited information in restricting the benefits to workers of switching sectors or their ability to do so. More recently, a number of papers have performed randomised controlled trials (RCTs) focused on labour markets. These papers provide evidence both for particular frictions as well as the effectiveness of possible policy responses. As it stands currently, this literature is almost completely divorced from the structural transformation literature. Building such frictions into structural transformation models and studying their aggregate implications has the potential to bridge this gap and provide important policy insights.

We end with a section that focuses on two open questions and the related data and theory that can help push this literature forward. First, on a theoretical front, these issues call for models in which labour market frictions, and thus the potential for policy-relevant tradeoffs, coexist with structural transformation. Despite the widespread acknowledgment of the policy-relevant costs associated with moving workers from farms in rural areas to manufacturing and service jobs in urban areas, most of the literature on structural transformation assumes that this reallocation of labour is frictionless and costless. These assumptions allow for analytical characterisations of the process of structural transformation that provide clear intuition, but they are silent on the role of frictions or policy implications.

Incorporating these factors requires a model with non-trivial firms and workers. Our second

suggestion is that further evidence is needed particularly on the role of firms in structural transformation. For example, we have little evidence on the importance of firm entry, reallocation, or exit for the process of structural transformation. Evidence of this type may shed further light on the nature of frictions to labour reallocation and the job ladder that workers face. It may also suggest useful policies given that firms ultimately are responsible for creating the jobs necessary for structural transformation.

2 Existing Evidence

A long literature in development economics has emphasised the existence and importance of gaps in labour productivity between the traditional (rural, agricultural) and modern (urban, industrial) sectors (Lewis, 1954; Kuznets, 1971). The importance of reallocating economic activity into the modern sector has been viewed as fundamental for growth for nearly as long (Rosenstein-Rodan, 1943; Lewis, 1954; Rostow, 1960).[1]

Newly available data have made it possible to document these differences in a detailed and systematic manner for a large number of sectors and countries. McMillan and Rodrik (2011) use a combination of data from the Groningen Growth and Development Center database as well as national data sources to construct labour productivity for nine sectors in 38 countries. The gap in average labour productivity between the most and least productive sectors is at least a factor of five in every country in their sample. They also find that the gaps are systematically larger in developing countries.[2]

These gaps already strongly suggest that the sectoral allocation of labour is inefficient. If we take sectoral output prices as given, then an efficient labour allocation requires that the marginal value product per unit of labour be equalised across sectors. Efficiency thus concerns marginal products per unit of labour rather than average products per worker. Under a Cobb-Douglas

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[1] A related literature documents similar facts about gaps between rural and urban regions; see Lagakos (2020) for a recent overview. Sectoral gaps and rural-urban gaps are related since agriculture is concentrated in rural areas, but the two are not identical. For example, Hnatkovska and Lahiri (2019) find that the trends for sectoral and regional wage gaps behave differently in China and India. Further, Eckert and Peters (2018) show that most of the process of US structural transformation from 1880-1940 happens within rather than between regions. For this review, we focus on research that deals with sectoral gaps specifically.

[2] Their preferred metric, the coefficient of variation of log sectoral labour productivity, is more than twice as large for the poorest as compared to the richest countries. See also Duarte and Restuccia (2010) on labour productivity differences or Herrendorf and Valentinyi (2012) on total factor productivity differences.

production function, the marginal value product of labour is equal to the labour share times the average product of labour. Standard estimates of sectoral labour shares do not vary anywhere near enough to rationalise the observed gaps in the average product of labour (McMillan and Rodrik, 2011). We return to the question of whether sectoral differences in hours worked or human capital per worker are large enough to rationalise the observed gaps below.

A large share of the relevant literature has focused on the agricultural productivity gap, which compares labour productivity in agriculture to the remainder of the economy. This focus is motivated by the fact that the typical developing country has a particularly unproductive agricultural sector and yet a high agricultural employment share, often over one half (Restuccia et al., 2008; Caselli, 2005). Gollin et al. (2014) show that the agricultural productivity gap remains large, a factor of three among the poorest quartile of countries in their sample, even after providing corrections to or alternative measures of sectoral labour inputs and value added.

These gaps suggest that a reallocation of labour among sectors, particularly from agriculture to non-agriculture, could increase total output substantially. The literature has investigated further whether this is true and, if so, what frictions inhibit workers from making the necessary switch. We divide the literature into three broad areas. First, we consider the evidence on sectoral gaps in wages and consumption. Second, we consider the evidence on labour market dynamics and worker flows across sectors. Third, we consider evidence on specific frictions that impede workers from switching sectors.

2.1 Do Gaps Represent Opportunities for Workers?

A first literature has investigated what labour productivity gaps imply for workers. This literature starts by documenting similarly large sectoral wage and consumption gaps (Gollin et al., 2014; Herrendorf and Schoellman, 2018; Hamory et al., forthcoming). These gaps are of interest because they describe outcomes directly experienced by workers. Studying them is thus informative about workers' private incentives to join or switch sectors. However, it should be noted that these gaps are less directly informative about the efficiency of labour allocations because labour market frictions can drive a wedge between wages and the marginal value product of labour. We return to this point in Section 2.3.

Following most of the work in this area, we focus our discussion on the gap between agri-

culture and non-agriculture. Much of the framework and discussion that follows extends to multiple sectors, but there is relatively little empirical work on the subject. The agricultural consumption or wage gap is a factor of two to three in most developing countries. This raises the possibility that the same worker could switch from agriculture to non-agriculture and improve wages and welfare. However, it could also be the case that workers in the two sectors differ in their unobserved productivity and that this difference explains the outcome gaps (Lagakos and Waugh, 2013). Further work is needed to disentangle these possibilities.

The Roy (1951) model provides a useful framework for thinking through inference about wage gaps in the face of unobserved heterogeneity and selection. To organise the discussion that follows, we consider a simple version of the model in the spirit of the previous literature (Lagakos et al., 2020b). There are two sectors, agriculture and non-agriculture, denoted by a and n. Workers are endowed with an unobserved productivity for working in each of the two possible sectors, with $\mathbb{Z} = (z_a, z_n)$ drawn from cdf $F(\mathbb{Z})$. The two sectors pay a wage rate per unit of labour input of p_a and p_n. Finally, we allow for a simple form of frictions: workers who choose the non-agricultural sector receive a fraction $e^{-\tau}$ of their wage, with the remainder lost. $\tau \in [0, \infty)$ is a measure of the extent of frictions.

This way of modeling frictions captures the case where the non-agricultural sector but not the agricultural sector is subject to labour taxes. It can also capture disamenities or costs that apply particularly to the non-agricultural sector, such as less desirable working conditions or a higher cost of living. It is also common to think about it as representing a more general friction to the reallocation of labour, such as acquiring the necessary information on job opportunities or physically relocating. In this case, the cost strictly speaking should apply only to workers who are considering switching from their initially assigned sector and should apply to any worker who switches sectors (Lagakos et al., 2020b). Still, the simple model offers useful insights that apply at the main margin of interest, which is trying to understand why more workers do not move to the higher-wage non-agricultural sector. It should be noted that this is indeed the dominant direction of switches for workers who do switch sectors (Hamory et al., forthcoming; Herrendorf and Schoellman, 2018).

Given this interpretation of the frictions, a worker's observed and actual wage if they choose agriculture is $w_a = p_a z_a$. On the other hand, their observed wage if they choose non-agriculture

is $w_n = p_n z_n$, but their actual effective wage would be $e^{-\tau} w_n$. They choose the sector with the higher effective wage, which implies that they work in the non-agricultural sector if $e^{-\tau} p_n z_n > p_a z_a$. The observed agricultural wage gap in this model is given by

$$\overline{\log(w_n)} - \overline{\log(w_a)} = \log(p_n) - \log(p_a) + \mathbb{E}\left[\log(z_n | e^{-\tau} w_n > w_a)\right] - \mathbb{E}\left[\log(z_a | e^{-\tau} w_n < w_a)\right].$$

It is useful to start with a benchmark version of the model in which all workers have the same ability in each sector, $z_a = z_n = 1$, and in which there are no distortions, $\tau = 0$. In this benchmark, $p_n = p_a$ is a necessary condition for there to be an interior solution to the sectoral allocation of labour. It follows that the agricultural wage gap $\overline{\log(w_n)} - \overline{\log(w_a)} = 0$.

If we step away from this benchmark, then the model generates wage gaps through two mechanisms. For clarity, we consider each separately. First, if there are distortions $\tau > 0$, then $e^{-\tau} p_n = p_a$ is a necessary condition for there to be an interior solution to the sectoral allocation of labour. The resulting agricultural wage gap is $\overline{\log(w_n)} - \overline{\log(w_a)} = \tau$. The homogeneous workers are indifferent between working in the two sectors because the higher observed non-agricultural wage is exactly offset by the frictions in that sector.

Second, if we instead allow for a non-degenerate distribution of abilities F, then the agricultural wage gap depends on equilibrium relative prices and the average ability of workers who select into the two sectors, $\mathbb{E}\left[\log(z_n | w_n > w_a)\right] - \mathbb{E}\left[\log(z_a | w_n < w_a)\right]$. In equilibrium there is a non-zero agricultural wage gap, but all workers at least weakly prefer to work in their chosen sector and no worker can be made better off through switching. These examples show that agricultural wage gaps are in principle equally consistent with frictions or selection; in the general model, both mechanisms contribute to the observed gap.

In order to make the case that agriculture wage gaps represent opportunities for the productive reallocation of workers, it is necessary to show that they are not explained mostly or entirely by selection. Unfortunately, it is well known since Heckman and Honoré (1990) that identification of the distribution F and the resulting selection effect in this model requires strong assumptions.[3] The essential problem is that we observe the outcomes associated with

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[3] Alvarez-Cuadrado et al. (2020) provide formulas that help characterise this selection effect in terms of the properties of F, notably the coefficient of variation of sectoral productivities and the correlation of productivities between sectors.

the choice each worker makes, but not the counterfactual outcomes associated with the foregone choices. The literature has taken three different approaches to address this challenge.

The most common approach uses the changes in outcomes experienced by workers who actually switch sectors. This approach is motivated by the fact that developing countries are experiencing structural transformation (if perhaps too slowly) and there are worker flows among sectors of the economy. This raises the question: do these workers experience large wage changes? The recent development of panel data sets that track workers over time in developing countries makes it possible to address this question.

Given the focus on heterogeneity and selection, it is important to be specific about who switches sectors. One assumption that explains why workers might choose to work in both sectors and that also yields simple insights is that workers who switch sectors are nearly indifferent between working in the two sectors, $e^{-\tau}w_n \approx w_a$ (Schoellman, 2020). Such workers might be induced to switch sectors by trend growth in p_n/p_a that causes them to switch from marginally preferring agriculture to marginally preferring non-agriculture. Under this assumption the log-wage gain for workers who switch sectors is approximately equal to τ, so that the wage gains for workers who switch sectors reveal the extent of labour market distortions.

Four studies jointly spanning four countries have used panel data to estimate the wage gains for such workers: Hamory et al. (forthcoming) in Indonesia and Kenya; Alvarez (2020) in Brazil; Pulido and Święcki (2019) in Indonesia; and Herrendorf and Schoellman (2018) in the US. Read as a whole, these papers support three main findings. First, there are indeed large cross-sectional gaps in outcomes: workers in non-agriculture enjoy higher wages and consumption. Second, workers who switch sectors from agriculture to non-agriculture experience improvements in those outcomes, while the fewer workers who switch from non-agriculture to agriculture experience deteriorations. Finally, the outcome changes experienced by switchers are typically 20-50% of the total cross-sectional gap.

Viewed through the lens of the simple theory provided here, these findings already suggest that as much as half of the sectoral wage gap reflects distortions that hinder the reallocation of workers between sectors. However, further work is needed. Lagakos et al. (2020b) propose an alternative theory with heterogeneous frictions and non-marginal switchers that interprets these findings differently. Further evidence is needed to discipline and refine these models.

Additionally, the findings currently span few countries. It would be useful to expand the set of countries to see if the results generalise. Lagakos et al. (2020b) provide a number of countries with the appropriate panel data to extend existing evidence. It would also be interesting to know whether the variation in the ratio of wage gains to cross-sectional wage gaps captures underlying heterogeneity in frictions for different countries; the current sample is too small to permit such analysis.

A second approach taken by Gai et al. (2020) is to estimate the Roy model formally. Best practice requires a variable that satisfies the exclusion restriction by shifting sectoral choices without affecting sectoral wages (French and Taber, 2011).[4] For this, the authors exploit the rollout of pensions to rural China in a context where grandparents, parents, and children live in close proximity. Pensions (paid to the grandparents) affect parents' willingness to migrate and join the non-agricultural sector by reducing their need to care for the grandparents or the children (who can be cared for by the grandparents). However, they do not affect the parents' sectoral wages directly.

The estimated structural model supports the existence of large barriers to switching sectors, equal to roughly one-half of non-agricultural earnings. This finding is consistent with the conventional wisdom that China has large barriers to migrating and switching sectors, particularly in the form of the *hukou* policy. The authors also use counterfactual policy simulations to show that the agricultural productivity gap would fall by 60% if *hukou* policies throughout China were set to the level of the most liberal region. This paper provides valuable evidence in its own right, but it also serves as a 'proof-of-concept' that this approach does indeed capture large distortions in a context where most researchers would expect them to be important. It would be useful to extend this approach to other countries and contexts to get a broader sense of how important frictions are elsewhere.

A final approach developed by Alvarez-Cuadrado et al. (2020) exploits the fact that many households in developing countries are simultaneously active in both agriculture and non-agriculture. Their model rationalises this fact by attributing to these households an inter-

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[4]An alternative would be to use experimental evidence to discipline the model. For example, Lagakos et al. (2020a) discipline a similar model of rural-urban migration using experimental evidence from Bryan et al. (2014). We are aware of no papers that have pursued this path to disentangling selection and sectoral wage gaps.

mediate level of comparative advantage. This knowledge is useful because households with intermediate comparative advantage are most likely to switch sectors in response to changes in policies or relative prices. They find that households with higher agricultural productivity are more likely to have intermediate comparative advantage. This finding works against a large role for selection, which would require the opposite assumption (Lagakos and Waugh, 2013). Their findings imply that distortions could be even more important for agricultural productivity gaps, although the authors do not provide an estimate of the magnitude. However, these findings are at the household level. Further work is required to understand whether they extend to or discipline models of workers who select between sectors.

To summarise, it is now well documented that there are large gaps in outcomes for workers employed in different sectors, even after adjusting for observable characteristics. These gaps could represent the effects of labour market distortions that prevent workers from switching sectors, but they could reflect differences in the unobserved abilities of workers who select into the two sectors. Disentangling the two is challenging, but the literature has so far utilised three different approaches. Each points to an important role for frictions in driving a wedge between wages in agriculture and non-agriculture.

2.2   How Dynamic are Labour Markets?

A complementary approach looks at the overall dynamism of labour markets in developing countries. We measure dynamism by looking at the patterns of gross labour market flows and net labour reallocation among sectors. The underlying idea is that if developing country labour markets have more frictions, this fact should manifest itself in patterns of how frequently workers switch jobs, what types of jobs they take when they switch, and which types of workers switch sectors.

Donovan et al. (2021) construct comparable measures of gross labour market flows such as the job-finding rate and separation rate for a sample of 45 countries. Their main finding is that flows are two to three times higher in developing countries than in developed countries. However, two further pieces of evidence suggest that these higher flows do not indicate a more rapid reallocation of labour to higher productivity uses.

First, these flows are not explained by more flexible labour market institutions in poorer

countries. This contrasts with an earlier literature that finds that labour market flows and labour market institutions are strong correlated among developed countries, and which led to the widespread interpretation that flows reflect better or more flexible labour market institutions (Jung and Kuhn, 2014; Engbom, 2020). This finding does not appear to generalise to poor and middle-income countries. Second, much of the labour market flows constitute churn among non-employment, subsistence self-employment, and low-earnings jobs. Workers in poorer countries are more likely to transition between these states, less likely to climb the job ladder to better jobs, and less likely to persist in better jobs if they do find them.

The fact that workers can reallocate among these jobs so frequently suggests that poor countries are not characterised by uniformly high labour market frictions that prevent workers from switching between any jobs. However, the fact that workers reallocate among marginal jobs rather than climb the job ladder and persist in high-paying work suggests that they face barriers to moving to stable, high-wage work.

A second, related literature documents facts about the net reallocation of labour between sectors during the process of structural transformation. These surveys use either repeated cross sections or panels of a representative sample of workers to investigate the characteristics of workers who actually switch sectors. The results provide further indirect evidence of frictions to labour reallocation.

A key finding is that much of structural transformation is accounted for by new cohorts of workers entering growing sectors while older cohorts of workers retire from shrinking sectors. This finding arises in studies focusing separately on the Korean growth miracle, Argentina, and the US (Topel, 1991; Pérez, 2018; Lee and Wolpin, 2006). Recently, Porzio et al. (2020) and Hobijn et al. (2018) exploit the widespread availability of harmonised international databases to document the same finding for a large set of countries spanning much of the globe. They find that roughly half of structural transformation can be attributed to entry of new cohorts and exit of retiring cohorts, with the share rising to 60-70% for the transition out of agriculture.

The fact that new cohorts play such a particular role in the process of structural transformation suggests that they find it easier or less costly to enter the growing sectors. This may be because they have more or different skills, or because they are more willing to make investments given that they can amortise the costs over their longer remaining working life.

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Whatever the reason, the fact that older workers do not switch sectors has costs. Hobijn et al. (2018) use an instrumental variable strategy to show that structural transformation lowers wages in shrinking sectors. Their point estimates show that a one percentage point decline in a sector's employment share lowers wages for workers in that sector by 1.6-2.9 log points, with the effect rising to 5.0-5.7 log points for the oldest workers.

Besides age, education and gender stand out as characteristics that seem to play a role in which workers switch sectors. Educated workers are particularly likely to exit agriculture and particularly likely to enter skill-intensive service sectors (Porzio et al., 2020). Several papers have documented an important role for gender in the form of a link between female labour force participation rates and the rise of the service sector (Rendall, 2018; Buera et al., 2019). To some extent, this appears to reflect the fact that women have a comparative advantage in services, possibly because it is less strength-intensive (Ngai and Petrongolo, 2017; Rendall, 2018). However, some of women's choices also appear to be affected by discrimination in schools and in the labour market (Altonji and Blank, 1999; Hsieh et al., 2019). To the extent that this is the case, discrimination both lowers women's wages and slows the pace of structural transformation.

2.3   What Barriers Prevent Reallocation of Workers?

The evidence that we have considered so far is indirect. Labour market frictions are inferred from the sizable wage gaps that are only partially explained by selection, from the churn among non-employment, subsistence self-employment, and low-earnings wage work in developing countries, and from the disproportionate role that new cohorts of workers play in the labour reallocation during structural transformation. These approaches are useful for providing evidence on the total effect of labour market frictions, but they are limited in their ability to speak to what those frictions might be or how policymakers might remedy them.

To make progress on these questions, we turn to the complementary literature that investigates specific factors that limit the reallocation of workers among sectors. We take a broad view of the literature in the sense that we look for all factors that impede the reallocation of labour, without requiring strict evidence that they are frictions that generate misallocation. In many cases there is little consensus on this important question.

An important barrier already discussed above is the scarcity of human capital in developing countries. There is substantial evidence for an important role for education, which matters along at least two margins. First, education is important for adopting new technologies that raise agricultural productivity, which is a key mechanism that generates structural transformation (Ngai and Pissarides, 2007). Welch (1970) shows that the returns to education among farmers in the US are higher in areas that have more farm-oriented research and development. Building on this idea, Foster and Rosenzweig (1996) show that the green revolution in India utilised and raised the return to education, which in turn stimulated investment in education. Skinner and Staiger (2000) show that state-level adoption of a variety of new technologies in the first half of the 20th century in the US correlates well with state education (measured by high school graduation rates).

Second, education plays an important role in determining workers' non-agricultural wages. The sectors that grow during structural transformation are generally more education-intensive and offer higher returns to schooling (Herrendorf and Schoellman, 2018; Buera et al., 2018). Given that developing countries typically lack both quantity and quality of education, workers can be expected to find it challenging to switch to these growing, skill-intensive sectors (Barro and Lee, 2013; Schoellman, 2012). Most countries are already expanding their school capacity over time, so that younger workers are much more educated than older ones in most developing countries. This phenomenon is a leading explanation for why new cohorts account for a disproportionate share of structural transformation. Porzio et al. (2020) provide direct evidence in support of this idea by evaluating the effects of a large number of education policy reforms. They find that new cohorts of workers who are quasi-experimentally exposed to more education are substantially less likely to choose agricultural employment.

Thus, education can be important for raising agricultural productivity and providing workers with better non-agricultural labour market options. Education also offers a clear role for policy. Efficient private investment in schooling requires well-functioning capital markets (Becker and Tomes, 1986). Given the limited capital markets in developing countries, governments there play an important role in financing more and higher-quality schools. They can also implement policies that compensate parents for the foregone labour earnings of their children, which is an important determinant of school attendance in developing countries (Jacoby and Skoufias,

1997).

In addition to education, a lack of life-cycle human capital accumulation may also present a barrier to structural transformation in developing countries. Lagakos et al. (2018) document that workers in developing countries have systematically flatter life-cycle wage profiles, suggesting lower rates of life-cycle human capital formation. As with education, experience human capital both boosts agricultural productivity and improves workers' labour market options outside agriculture. Several papers document the importance of experience for agricultural productivity (Rosenzweig and Wolpin, 1985; Foster and Rosenzweig, 1995). Experience and learning appear particularly important for the diffusion of new crops or practices that substantially raise productivity (Foster and Rosenzweig, 1995; Conley and Udry, 2010). At the same time, experience human capital is more highly valued in non-agriculture (Herrendorf and Schoellman, 2018).

An important contributor to life-cycle human capital accumulation is training. Ma et al. (2020) document that developing countries also have lower rates of on-the-job training. A growing literature has also begun to study training and apprenticeship in developing countries. Hardy et al. (2019) find that access to an apprenticeship programme in Ghana shifts apprentices from wage work into self-employment after completion. This implies lower income on average, but they uncover substantial heterogeneity by quality of the firm manager (measured by experience and profit) to whom the apprentice is attached. Alfonsi et al. (2020) go a step further, comparing vocational training to apprenticeship with an RCT in Uganda. Both programmes generate increases in employment, but this effect is long-lasting for vocational trainees while it fades out over the course of four years for apprentices. Cho et al. (2016) highlight the potential interaction with other frictions by showing that women are more likely to drop out of vocational training in Malawi due to family obligations.

This RCT-level literature primarily focuses on low-skilled sectors, with unemployed youths matching with small and medium-scale firms. Caicedo et al. (2020) take a broader view of such programmes and study the introduction of a nationwide Colombian apprenticeship programme. When firms were required to hire a (size-specific) number of apprentices and pay them 75% of the minimum wage, more than half of firms in high-skilled sectors were willing to pay a non-compliance fine to not hire. To the extent that training within a high-skilled sec-

tor generates larger returns from apprenticeship, their results provide one explanation for the relatively lacklustre performance of apprenticeship in the aforementioned RCTs. Furthermore, Caicedo et al. (2020) study counterfactual apprenticeship programmes in an estimated general equilibrium model. Relative to the baseline programme, lowering the required apprentice wage in high-skilled sectors, and instead relying on the higher future earnings growth from apprenticing in these sectors to keep demand high, could generate an equally-sized trained workforce while increasing GDP by 3.6%. Taken together, these results suggest an important role for such active training programmes, but they also suggest that we require a better understanding of sector- and firm-level heterogeneity when designing policy.

In addition to acquiring skills, workers also need to know and be able to demonstrate their value to employers. A recent literature shows that imperfect information about skills may constitute a barrier to employment. Several papers document that providing additional information about workers' skills to the worker or potential employers generates more matches that are also more stable. Abebe et al. (forthcoming) find that allowing workers to signal skills more easily in urban Ethiopia increases employment and earnings four years later. Similarly, Bassi and Nansamba (2019) show that revealing worker 'soft' skills (communication ability, trustworthiness) to both the worker and potential firms in Uganda leads to better sorting. Carranza et al. (2020) disentangle whether such frictions stem from workers' imperfect knowledge of their own skills or their inability to signal skills to firms by experimentally manipulating each margin in South Africa. They find an important role for both. Finally, imperfect information also helps explain the large and persistent role for referrals in labour markets (Beaman and Magruder, 2012). These findings suggest that, for example, certification programmes that allow workers to provide evidence of their relevant knowledge or skills to employers might accelerate structural transformation.

Efficiency wage theories also explain why workers may find it hard to move to take advantage of wage gaps. In these theories, a worker's productivity is a function of their wage. Employers internalise this fact and offer higher wages to induce higher productivity, even if other applicants offer to do the same job for lower pay (Katz, 1986). One variant of these theories that has received much attention in development economics posits that workers' productivity depends on their caloric intake (Leibenstein, 1957; Mazumdar, 1959; Strauss, 1986). If efficiency wage

considerations are more common in the manufacturing or service sectors, this could explain why wages there are higher but workers do not switch sectors.

Geography can also be an important barrier to switching sectors. In many cases switching sectors also means moving, often to urban areas. Such moves are potentially constrained by distance and missing infrastructure (Tsivanidis, 2019; Brooks and Donovan, 2020), lack of information (Baseler, 2020), or explicit policies that restrict spatial movement (Ngai et al., 2019). The importance of geographical constraints is a central feature of the literature on rural-urban migration (Lagakos, 2020). This suggests important complementarities between Theme 2 (Labour) and Theme 4 (Trade and Spatial Frictions) within STEG.

Two other well-known classes of theories work through the mechanism of dampening wages in productive sectors, which reduces workers' incentives to switch sectors. The first class of theories posits that firms may have monopsony power in labour markets. The declining labour share in many developed countries has led to a revival of interest in this topic. One useful summary statistic in this literature is the firm-level labour supply elasticity. In the simplest neoclassical benchmark (homogeneous workers and firms), perfectly competitive labour markets imply that this supply elasticity should be infinity, because a firm that offers any below-market wage would attract no workers, while a firm that offers any above-market wage would attract them all. Recent work for the US finds significant evidence for market power, with the estimated firm-level labour supply elasticity in the range of 4.2-5.8 (Azar et al., 2019; Bassier et al., 2020).

A few papers have extended this type of analysis into developing countries and found yet lower estimates of the firm-level labour supply elasticity, indicating even more market power. Brooks et al. (2019) estimate the firm-level labour supply elasticity in China and India and find that it ranges from 0.4-2.5.[5] Amodio and de Roux (2020) estimate the firm-level labour supply for Colombia to be 2.5. This level of market power has important consequences for wages. Brooks et al. (2019) estimate that market power lowers the labour share by 10 and 15 percentage points in China and India. If these findings are more widespread, then they suggest that pro-competitive policies would be likely to boost wages and hasten the pace of structural transformation.

A second group of theories that work through a similar mechanism emphasise the presence

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[5]Soundararajan (2019) also shows that the minimum wages in India have large wage effects and small employment effects, consistent with firms enjoying monopsony market power.

of a large informal economy in most developing countries (La Porta and Shleifer, 2014). While earlier work treats the formal and informal sectors as segmented markets, subsequent research reveals substantial overlap and transition between these sectors (Maloney, 1999, 2004). In some cases a single firm will have both formal and informal workers (Ulyssea, 2018). Given this, most modern work models informality as a choice that workers and firms make (Albrecht et al., 2009; Almeida and Carneiro, 2012; Meghir et al., 2015; Bobba et al., forthcoming).

Formal-sector firms are subject to regulation and taxation. Some of the taxes they pay are used to fund social benefits for formal-sector workers. Formal-sector firms pay lower wages than they otherwise would, both because their profits are directly distorted and because workers value the social benefits and are willing to accept lower wages as a compensating differential. Thus, to the extent that formality is correlated with the growing sectors of structural transformation, it implies lower wages gaps and possibly less incentive to move.

Amodio et al. (2021) provide evidence that there are also important spillovers between the market power of formal-sector firms and the size of the informal sector as well as wages paid there, suggesting important linkages between these two theories that merit further exploration. Recent work by Bobba et al. (forthcoming) also suggests that informality depresses human capital formation, which implies that the presence of a large informal sector may have important dynamic implications.

Finally, a large literature documents the existence of frictions that prevent the reallocation of labour out of agriculture particularly. Here, we have in mind frictions such as imperfect or missing land markets or distortions that prevent the scaling up of productive farms (Adamopoulos and Restuccia, 2014; Restuccia and Santaeulalia-Llopis, 2017). Although many of these frictions touch on the labour market, they are also well covered by Pathfinding Paper 5; we refer interested readers to Gollin (2021).

3   Framework and Open Questions

The literature discussed in previous sections highlights three critical and complementary points. First, there exist wage gaps that do (at least in part) reflect opportunities for policy to generate economic growth. Second, labour market flows in developing countries point to frictions that

prevent workers, particularly older ones, from finding high-wage jobs in growing sectors. Third, there exists clear micro evidence of a host of labour market frictions that slow the reallocation of workers among sectors.

An important next step for this literature is to develop models of sectoral labour reallocation and structural transformation in the face of labour market frictions. In most of the classic work on structural transformation labour is assumed to be homogeneous and fully mobile across sectors. Structural transformation is thus both efficient and costless. These models permit elegant analytical solutions and provide clear intuition for how structural transformation can arise in response to changing technologies or non-homothetic preferences. However, they need to be amended to permit meaningful discussion of the role of labour market frictions or any possible role for policy.

Models that incorporate labour market frictions are challenging to construct. At the aggregate level, structural transformation is, by definition, unbalanced, in the sense that the relative size of the sectors changes continuously. The existing literature has shown that models of structural transformation have analytical solutions, as long as labour is homogeneous and can be frictionlessly reallocated among sectors. In order to integrate frictional labour markets, new analytical techniques or computational methods that allow for unbalanced growth are necessary. Recent work by Buera et al. (2020) provides a new way to characterise the evolution of structural transformation models that helps ease this burden.

A small set of existing papers provide models with structural transformation and frictions that may be useful building blocks. One potentially useful addition in this vein is Feng et al. (2018). They construct a model in which higher unemployment is induced by skill-biased structural change, which causes more search (and thus more failure) for the lucrative jobs in skill-biased sectors. A second is Caselli and Coleman (2001), who analyse the US structural transformation from agriculture to non-agriculture using a model where switching sectors requires workers to pay a cost. This deviation is simple enough that the model still permits analytical solutions. However, the stylised, one-way distortion does not yet give much scope for policy analysis.

Three recent papers have developed models with richer distortions in the spirit of Caselli and Coleman (2001). In each, workers make joint human capital investments and sector or

occupation choices in an environment with changing technologies. Each also permits analytical solutions. Porzio et al. (2020) explicitly model the role of human capital investment for the transition out of agriculture. The paper's focus is on understanding the role of time versus cohort effects for the reallocation of labour, but the model may be suitable for further analysis. Adão et al. (2020) and Dvorkin and Monge-Naranjo (2019) provide models of workers facing a technological transition generated by cognitive-biased or task-biased technical change. Although these papers are not formulated as models of structural transformation, it may be possible to re-interpret or extend them for this purpose.

Finally, Hobijn et al. (2018) formulate a model of structural transformation with frictions to entering or switching between sectors that is amenable to computational analysis. The key is to frame each worker's sectoral choices as part of a dynamic discrete choice problem, which permits the use of tools from a well-developed literature from labour economics.

It is noteworthy that in all of these papers the underlying friction is related to human capital investment: workers need education, skills, or training before they can switch sectors or find it optimal to switch sectors. This investment is often somewhat abstract, in the sense that there is little attempt to connect it with actual investments made by workers in the data. While Porzio et al. (2020) provide evidence that human capital in the form of education plays a role in the process of structural transformation, this commonality likely reflects our lack of knowledge about alternative frictions. Returning to the last section, our evidence about exactly which frictions are most important quantitatively is still limited and not well integrated with models of structural transformation.

A second notable absence in this literature is significant discussion of the role of firms. Ding et al. (2019), for example, show that one third of the decline in US manufacturing is accounted for by shifts to services within continuing manufacturing firms. We have little evidence, especially in developing countries, on how firms contribute to structural transformation through entry, transitions between sectors, or exit. As a consequence, we have little evidence on how firm decisions affect workers. A second related question is whether the patterns of worker and firm sorting differ across countries at different stages of development. A useful benefit here is the existence of a suite of theoretical and statistical tools to study these questions in developed countries (Abowd et al., 1999; Borovičková and Shimer, 2020). Matched employer-employee

data would similarly help construct a more complete picture of the job ladder in developing countries.

4 Conclusion

Growth requires a structural transformation of the economy among sectors. The role of labour markets is to enable the movement of workers and jobs from shrinking and less productive to growing and more productive sectors. Labour market frictions interfere with this process by impeding the ability of or incentive for workers to take advantage of these opportunities. They trap workers in low-wage work, exacerbating poverty. They also slow structural transformation and growth for the entire economy.

We reviewed both indirect and direct evidence on these labour market frictions. We showed that there are sizable gaps in labour productivity, wages, and consumption among sectors and that these gaps are larger in developing countries. Existing evidence suggests that these gaps are not entirely accounted for by selection. We showed that labour market flows in developing countries point to frictions that prevent workers, particularly older ones, from finding high-wage jobs in growing sectors. Finally, we reviewed evidence from an extensive literature that documents specific frictions that impede labour reallocation.

We have also noted several avenues for further research. In many places our understanding is preliminary or incomplete and further research is needed. Integrating the evidence on the specific nature and extent of frictions into existing models of structural transformation offers the potential for serious policy analysis and evaluation of the aggregate gains from removing frictions. New evidence on the role firms play in the process of structural transformation could help clarify the role of the job ladder in structural transformation. This requires both new data and new theory, but with the potential for important gains in our understanding of structural transformation.

References

Abebe, Girum, Stefano Caria, Marcel Fafchamps, Paolo Falco, Simon Franklin, and Simon Quinn, "Anonymity or Distance? Job Search and Labour Market Exclusion in a Growing African City," *Review of Economic Studies*, forthcoming.

Abowd, John M., Francis Kramarz, and David N. Margolis, "High Wage Workers and High Wage Firms," *Econometrica*, 1999, *67* (2), 215–333.

Adão, Rodrigo, Martin Beraja, and Nitya Pandalai-Nayar, "Skill-Biased Technological Transitions," 2020. Working Paper.

Adamopoulos, Tasso and Diego Restuccia, "The Size Distribution of Farms and International Productivity Differences," *American Economic Review*, 2014, *104* (6), 1667–97.

Albrecht, James, Lucas Navarro, and Susan Vroman, "The Effects of Labour Market Policies in an Economy with an Informal Sector," *Economic Journal*, 2009, *119* (539), 1105–1129.

Alfonsi, Livia, Oriana Bandiera, Vittorio Bassi, Robin Burgess, Imran Rasul, Munshi Sulaiman, and Anna Vitali, "Tackling Youth Unemployment: Evidence from a Labor Market Experiment in Uganda," *Econometrica*, 2020, *88* (6), 1159–1178.

Almeida, Rita and Pedro Carneiro, "Enforcement of Labor Regulation and Informality," *American Economic Journal: Applied Economics*, 2012, *4* (3), 64–89.

Altonji, Joseph G. and Rebecca M. Blank, "Race and Gender in the Labor Market," in Orley C. Ashenfelter and David Card, eds., *Handbook of Labor Economics*, Vol. 3C, Elsevier, 1999, chapter 48, pp. 3143–3259.

Alvarez-Cuadrado, Francisco, Francesco Amodio, and Markus Poschke, "Selection and Absolute Advantage in Farming and Entrepreneurship," 2020. Working Paper.

Alvarez, Jorge A., "The Agricultural Wage Gap: Evidence from Brazilian Micro-data," *American Economic Journal: Macroeconomics*, 2020, *12* (1), 153–173.

Amodio, Francesco and Nicolás de Roux, "Labor Market Power in Developing Countries: Evidence from Colombian Plants," 2020. mimeo, McGill University.

_ , **Pamela Medina, and Monica Morlacco**, "Labor Market Power, Selection and Informality in Peru," 2021. mimeo, McGill University.

Azar, José, Steven Berry, and Ioana Elena Marinescu, "Estimating Labor Market Power," 2019. mimeo, Yale University.

Barro, Robert J. and Jong Wha Lee, "A New Data Set of Educational Attainment in the World, 1950–2010," *Journal of Development Economics*, 2013, *104*, 184–198.

Baseler, Travis, "Hidden Income and the Perceived Returns to Migration: Experimental Evidence from Kenya," 2020. Working Paper.

Bassi, Vittorrio and Aisha Nansamba, "Screening and Signaling Non-Cognitive Skills: Experimental Evidence from Uganda," 2019. Mimeo, University of Southern California.

Bassier, Ihsaan, Arindrajit Dube, and Suresh Naidu, "Monopsony in Movers: The Elasticity of Labor Supply to Firm Wage Policies," 2020. NBER Working Paper 27755.

Beaman, Lori and Jeremy Magruder, "Who Gets the Job Referral? Evidence from a Social Networks Experiment," *American Economic Review*, 2012, *102* (7), 3574–3593.

Becker, Gary S. and Nigel Tomes, "Human Capital and the Rise and Fall of Families," *Journal of Labor Economics*, 1986, *4* (3), S1–S39.

Bobba, Matteo, Luca Flabbi, Santiago Levy, and Mauricio Tejada, "Labor Market Search, Informality, and On-the-Job Human Capital Accumulation," *Journal of Econometrics*, forthcoming.

Borovičková, Katarína and Robert Shimer, "High Wage Workers Work for High Wage Firms," 2020. Working Paper, NYU.

Brooks, Wyatt and Kevin Donovan, "Eliminating Uncertainty in Market Access: The Impact of New Bridges in Rural Nicaragua," *Econometrica*, 2020, *88* (5), 1965–1997.

Brooks, Wyatt J., Joseph P. Kaboski, Yao Amber Li, and Wei Qian, "Exploitation of Labor? Classical Monopsony Power and Labor's Share," 2019. mimeo, University of Notre Dame.

Bryan, Gharad, Shyamal Chowdhury, and A Mushfiq Mobarak, "Underinvestment in profitable technologies when experimenting is costly: evidence from a migration experiment in Bangladesh," *Econometrica*, 2014, *82* (5), 1671–1748.

Buera, Francisco J., Joseph P. Kaboski, and Min Qiang Zhao, "The Rise of Services: The Role of Skills, Scale, and Female Labor Supply," *Journal of Human Capital*, 2019, *13* (2), 157–187.

_ , _ , **Marti Mestieri, and Daniel G. O'Connor**, "The Stable Transformation Path," 2020. NBER Working Paper 27731.

Buera, Francisco J, Joseph P Kaboski, Richard Rogerson, and Juan I. Vizcaino, "Skill-Biased Structural Change," 2018. mimeo, Washington University in St. Louis.

Caicedo, Santiago, Miguel Espinosa, and Arthur Seibold, "Unwilling to Train? Firm Responses to the Colombian Apprenticeship Regulation," 2020. mimeo.

Carranza, Eliana, Robert Garlick, Kate Orkin, and Neil Rankin, "Job Search and Hiring with Two-Sided Limited Information about Workseekers' Skills," 2020. Mimeo.

Caselli, Francesco, "Accounting for Cross-Country Income Differences," in Philippe Aghion and Steven N. Durlauf, eds., *Handbook of Economic Growth*, Vol. 1A, Elsevier, 2005, chapter 9, pp. 679–741.

_ **and Wilbur John Coleman**, "The U.S. Structural Transformation and Regional Convergence: A Reinterpretation," *Journal of Political Economy*, 2001, *109* (3), 584–616.

Cho, Yoonyoung, Davie Kalomba, Ahmed Mushfiq Mobarak, Victor Orozco, and Derek Wolfson, "Gender Differences in the Effects of Vocational Training Constraints on Women and Dropout Behavior," 2016. mimeo.

Conley, Timothy G. and Christopher R. Udry, "Learning about a New Technology: Pineapple in Ghana," *American Economic Review*, 2010, *100* (1), 35–69.

Ding, Xiang, Teresa C. Fort, Stephen J. Redding, and Peter K. Schott, "Structural Change Within Versus Across Firms: Evidence from the United States," 2019. mimeo, Harvard.

Donovan, Kevin, Will Jianyu Lu, and Todd Schoellman, "Labor Market Dynamics and Development," 2021. Yale Economic Growth Center Discussion Paper 1079.

Duarte, Margarida and Diego Restuccia, "The Role of the Structural Transformation in Aggregate Productivity," *Quarterly Journal of Economics*, 2010, *125* (1), 129–173.

Dvorkin, Maximiliano A. and Alexander Monge-Naranjo, "Occupation Mobility, Human Capital and the Aggregate Consequences of Task-Biased Innovations," 2019. Federal Reserve Bank of St. Louis Working Paper 2019-013C.

Eckert, Fabian and Michael Peters, "Spatial Structural Change," 2018. mimeo, Yale University.

Engbom, Niklas, "Labor Market Fluidity and Human Capital Accumulation," 2020. Mimeo, New York University.

Feng, Ying, David Lagakos, and James E. Rauch, "Unemployment and Development," 2018. Manuscript, UC San Diego.

Foster, Andrew D. and Mark R. Rosenzweig, "Learning by Doing and Learning from Others: Human Capital and Technical Change in Agriculture," *Journal of Political Economy*, 1995, *103* (6), 1176–1209.

_ **and** _ , "Technical Change and Human-Capital Returns and Investments: Evidence from the Green Revolution," *American Economic Review*, 1996, *86* (4), 931–953.

French, Eric and Christopher Taber, "Identification of Models of the Labor Market," in Orley C. Ashenfelter and David Card, eds., *Handbook of Labor Economics*, Vol. 4a, Amsterdam: North-Holland, 2011, chapter 6, pp. 537–617.

Gai, Qingen, Naijia Guo, Bingjing Li, Qinghua Shi, and Xiaodong Zhu, "Migration Costs, Sorting, and Agricultural Productivity Gap," 2020. mimeo, University of Toronto.

Gollin, Doug, David Lagakos, and Mike Waugh, "The Agricultural Productivity Gap," *Quarterly Journal of Economics*, 2014, *129* (2), 939–993.

Gollin, Douglas, "Agricultural Productivity and Structural Transformation: Evidence and Questions for African Development," 2021. STEG Pathfinding Paper 5.

Hamory, Joan, Marieke Kleemans, Nicholas Y. Li, and Edward Miguel, "Reevaluating Agricultural Productivity Gaps with Longitudinal Microdata," *Journal of the European Economic Association*, forthcoming.

Hardy, Morgan, Isaac Mbiti, Jamie McCasland, and Isabelle Salcher, "The Apprenticeship-to-Work Transition: Experimental Evidence from Ghana," 2019. World Bank Working Paper 8851.

Harris, John R. and Michael P. Todaro, "Migration, Unemployment and Development: A Two-Sector Analysis," *American Economic Review*, 1970, *60* (1), 126–142.

Heckman, James J. and Bo E. Honoré, "The Empirical Content of the Roy Model," *Econometrica*, 1990, *58* (5), 1121–1149.

Herrendorf, Berthold and Akos Valentinyi, "Which Sectors Make Poor Countries So Unproductive?," *Journal of the European Economic Association*, 2012, *10* (2), 323–341.

__ **and Todd Schoellman**, "Wages, Human Capital, and Barriers to Structural Transformation," *American Economic Journal: Macroeconomics*, 2018, *10* (2), 1–23.

Hnatkovska, Viktora and Amartya Lahiri, "Urbanization, Structural Transforation, and Rural-Urban Disparities in China and India," 2019. mimeo, University of British Columbia.

Hobijn, Bart, Todd Schoellman, and Alberto Vindas Q., "Structural Transformation by Cohort," 2018. Working Paper.

Hsieh, Chang-Tai, Erik Hurst, Charles I. Jones, and Peter J. Klenow, "The Allocation of Talent and U.S. Economic Growth," *Econometrica*, 2019, *87* (5), 1439–1474.

Jacoby, Hanan G. and Emmanuel Skoufias, "Risk, Financial Markets, and Human Capital in a Developing Country," *Review of Economic Studies*, 1997, *64* (3), 311–335.

Jung, Philip and Moritz Kuhn, "Labour Market Institutions and Worker Flows: Comparing Germany and the US," *Economic Journal*, 2014, *124* (581), 1317–1342.

Katz, Lawrence F., "Efficiency Wage Theories: A Partial Evaluation," *NBER Macroeconomics Annual*, 1986, *1*, 235–290.

Kuznets, Simon, *Economic Growth of Nations: Total Output and Production Structure*, Harvard University Press, 1971.

_ , "Modern Economic Growth: Findings and Reflections," *American Economic Review*, 1973, *63*, 247–258.

La Porta, Rafael and Andrei Shleifer, "Informality and Development," *Journal of Economic Perspectives*, 2014, *28* (3), 109–126.

Lagakos, David, "Urban-Rural Gaps in the Developing World: Does Internal Migration Offer Opportunities?," *Journal of Economic Perspectives*, 2020, *34* (3), 174–192.

_ , **Ahmed Mushfiq Mobarak, and Michael E. Waugh**, "The Welfare Effects of Encouraging Rural-Urban Migration," 2020. mimeo, Boston University.

_ **and Michael E. Waugh**, "Selection, Agriculture, and Cross-Country Productivity Differences," *American Economic Review*, 2013, *103* (2), 948–980.

_ , **Benjamin Moll, Tommaso Porzio, Nancy Qian, and Todd Schoellman**, "Life Cycle Wage Growth Across Countries," *Journal of Political Economy*, 2018, *126* (2), 797–894.

_ , **Samuel Marshall, Ahmed Mushfiq Mobarak, Corey Vernot, and Michael E. Waugh**, "Migration Costs and Observational Returns to Migration in the Developing World," *Journal of Monetary Economics*, 2020, *113*, 138–154.

Lee, Donghoon and Kenneth I. Wolpin, "Intersectoral Labor Mobility and the Growth of the Service Sector," *Econometrica*, 2006, *74* (1), 1–46.

Leibenstein, Harvey, *Economic Backwardness and Economic Growth*, New York: Wiley, 1957.

Lewis, W. Author, "Economic Development with Unlimited Supplies of Labour," *The Manchester School*, 1954, *22* (2), 139–191.

Ma, Xiao, Alejandro Nakab, and Daniela Vidart, "Human Capital Investment and Development: The Role of On-the-job Training," 2020. mimeo, UCSD.

Maloney, William F., "Does Informality Imply Segmentation in Urban Labor Markets? Evidence from Sectoral Transitions in Mexico," *World Bank Economic Review*, 1999, *13* (2), 275–302.

_ , "Informality Revisited," *World Development*, 2004, *32* (7), 1159–1178.

Mazumdar, Dipak, "The Marginal Productivity Theory of Wages and Disguised Unemployment," *Review of Economic Studies*, 1959, *26* (3), 190–197.

McMillan, Margaret S. and Dani Rodrik, "Globalization, Structural Change and Productivity Growth," in Mark Bachetta and Marion Jansen, eds., *Making Globalization Socially Sustainable*, Geneva, Switzerland: International Labor Organization, 2011.

Meghir, Costas, Renata Narita, and Jean-Marc Robin, "Wages and Informality in Developing Countries," *American Economic Review*, 2015, *105* (4), 1509–1546.

Ngai, L. Rachel and Barbara Petrongolo, "Gender Gaps and the Rise of the Service Economy," *American Economic Journal: Macroeconomics*, 2017, *9* (4), 1–44.

Ngai, L. Rachel and Christopher A. Pissarides, "Structural Change in a Multisector Model of Growth," *American Economic Review*, 2007, *97* (1), 429–443.

Ngai, L. Rachel, Christopher A. Pissarides, and Jin Wang, "China's Mobility Barriers and Employment Allocations," *Journal of the European Economic Association*, 2019, *17* (5), 1617–1653.

Pérez, Santiago, "Railroads and the Rural to Urban Transition: Evidence from 19th-Century Argentina," 2018. mimeo, UC Davis.

Porzio, Tommaso, Federico Rossi, and Gabriella Satangelo, "The Human Side of Structural Transformation," 2020. Working Paper.

Pulido, José and Tomasz Święcki, "Barriers to Mobility or Sorting? Sources and Aggregate Implications of Income Gaps across Sectors in Indonesiai," 2019. Working Paper.

Rendall, Michelle, "Brain versus Brawn: The Realization of Women's Comparative Advantage," 2018. mimeo, Monash University.

Restuccia, Diego and Raul Santaeulalia-Llopis, "Land Misallocation and Productivity," 2017. NBER Working Paper 23128.

_ , **Dennis T Yang, and Xiaodong Zhu**, "Agriculture and Aggregate Productivity: A Quantitative Cross-Country Analysis," *Journal of Monetary Economics*, March 2008, *55* (2), 234–250.

Rosenstein-Rodan, Paul N., "Problems of Industrialization of Eastern and South-Eastern Europe," *Economic Journal*, 1943, *53* (210), 202–211.

Rosenzweig, Mark R. and Kenneth I. Wolpin, "Specific Experience, Household Structure, and Intergenerational Transfers: Farm Family Land and Labor Arrangements in Developing Countries," *Quarterly Journal of Economics*, 1985, *100* (Supplement), 961–987.

Rostow, Walt W., *The Stages of Economic Growth: A Non-Communist Manifesto*, Cambridge: Cambridge University Press, 1960.

Roy, A.D., "Some Thoughts on the Distribution of Earnings," *Oxford Economic Papers*, 1951, *3* (2), 135–146.

Schoellman, Todd, "Education Quality and Development Accounting," *Review of Economic Studies*, 2012, *79* (1), 388–417.

_ , "Comment on 'Migration Costs and Observational Returns to Migration in the Developing World'," *Journal of Monetary Economics*, 2020, *113*, 155–157.

Skinner, Jonathan and Douglas Staiger, "Technology Adoption from Hybrid Corn to Beta Blockers," in A.J. Culyer and J. P. Newhouse, eds., *Handbook of Health Economics*, Amsterdam: Elsevier, 2000.

Soundararajan, Vidhya, "Heterogeneous Effects of Imperfectly Enforced Minimum Wages in Low-Wage Labor Markets," *Journal of Development Economics*, 2019, *140*, 355–374.

Strauss, John, "Does Better Nutrition Raise Farm Productivity?," *Journal of Political Economy*, 1986, *94* (2), 297–320.

Topel, Robert, "Specific Capital, Mobility, and Wages: Wages Rise with Job Seniority," *Journal of Political Economy*, 1991, *99* (1), 145–176.

Tsivanidis, Nick, "Evaluating the Impact of Urban Transit Infrastructure: Evidence from Bogotá's TransMilenio," 2019. mimeo, UC Berkeley.

Ulyssea, Gabriel, "Firms, Informality, and Development: Theory and Evidence from Brazil," *American Economic Review*, 2018, *108* (8), 2015–2047.

Welch, Finis, "Education in Production," *Journal of Political Economy*, 1970, *78* (1), 35–59.

World Bank, *World Development Report 2013: Jobs*, Washington, D.C.: World Bank, 2013.