Mobility Frictions, Remittances and the Distributional Effects of International Trade*

Sarah Schroeder & Rui Zhang †

Aarhus University

Very preliminary - please do not circulate

September 1, 2021

Abstract

In this paper, we study the role of households' 'partial migration' decisions and the associated remittances in distributing the benefits of growing trade across space. Relative to 'complete migration', partial migration implies that part of the household remains in the rural area, while at least one household member migrates to an urban area, usually for better employment opportunities. Here, remittances capture domestic, inter-regional transfers between urban and rural member of the household. We use Chinese household and trade data to establish novel empirical facts that connect trade, migration, and remittances. We quantify the role of partial migration and remittances by explicitly incorporating these channels in a spatial general equilibrium model of trade and migration. Our quantitative model delivers novel insights about the distributional implications of international trade in the presence of mobility frictions and heterogeneous forms of domestic migration. We further investigate the interplay between trade and migration policy in shaping aggregate welfare.

JEL classification: F14, F16, J24, O18, P23, P33, R12

Keywords: Remittances, Trade, Migration, Mobility frictions,Distribution

*We are grateful to conference participants at the Aarhus-Kiel Workshop 2019 and the European Meeting of the UEA 2021 for helpful comments and suggestions.

†Department of Economics, Aarhus University, 3 Fuglesangs Allé 4, 8210 Aarhus V, Denmark; Schroeder: sschroeder@econ.au.dk; Zhang: rayzhangrui23@econ.au.dk

1 Introduction

Rising exports in the manufacturing sector in China have induced a large number of rural residents to migrate to urban areas for better employment opportunities (see e.g. Fan (2019), Facchini et al. (2019), Tombe and Zhu (2019) and Zi (2020)). In most cases these rural-to-urban migrants are separated from their immediate and extended family geographically, and remit a considerable amount of their income to support their family in the rural home town. Such a "partial migration" arrangement is a way to overcome migration frictions and high living costs in the urban areas. This further implies that higher labor returns in the urban areas due to rising exports are shared within household and across locations to benefit the residents who stay in the rural areas.

In this paper, we quantify the role of households' 'partial migration' decisions and the associated remittances in distributing the benefits of growing trade across space. In this context, remittances capture domestic, inter-regional transfers between urban and rural member of the household. Our empirical analysis uses three different sets of data: the Household Income Project (CHIP), China's Population Census and China's Customs Trade data. We define a partial migrant as a rural resident migrating to an urban area, where his/her family remains in the rural home town.

We establish three novel empirical facts that connect trade, migration, and remittances. First, we find that a manufacturing export growth in the potential emigration destination prefecture increases the emigration probability of rural residents. Second, we document that partial migration accounts for 37% of the total rural-to-urban migrants. Meanwhile, partial migrants are 20% more likely to remit part of their income to their rural families, and remit 10% more of their income compared with other migrants. Third, around 30% of the rural households send out partial migrants. These households enjoy a 10% higher household income than households sending no migrant. Rural household income is also increasing in the number of partial migrants in the households. The empirical evidence suggests that a considerable share of rural-to-urban migrants, triggered by growing manufacturing exports, are partial migrants, who tend to send a large share of their incomes as remittances to support their families in the rural homes.

We quantify the role of partial migration and remittances by explicitly incorporating these channels in a spatial general equilibrium model of trade and migration similar to the one by Caliendo et al. (2019). In doing so, our paper is – to the best of our knowledge – the first to document and account for the empirical facts regarding trade, migration and remittances qualitatively as well as quantitatively. In particular, we allow a rural resident to choose between two types of migration when he/she decides to migrate. A potential migrant can either choose "complete migration" by moving the whole household into the urban area, which entails higher living costs, but lower migration cost. Alternatively, he/she can choose "partial migration" by moving alone to the urban area while having other family members stay in the rural home town, which incurs lower living costs, but comes along with higher migration costs due to household separation. Partial migration, therefore, serves as an imperfect but less costly option of migration to exploit the employment opportunities across different locations.

To illustrate the quantitative importance of the mechanism we propose, we calibrate the effect of China's trade opening by conceptualising our general equilibrium in a stylised world. Our quantitative exercise of a reduction in bilateral trade costs suggests that the mode of migration, as well as the associated remittances, are quantitatively important channels for the distributional implications of international trade. In particular, the remittances effect ihas not been considered previously in the literature. Operating through changes in migration shares, this channel has important implications for measuring between region inequality and overall welfare. In so doing, our quantitative model delivers novel insights about the distributional implications of international trade in the presence of mobility frictions and heterogeneous forms of domestic migration.

Related literature. This paper contributes to a large body of research studying the effect of international trade on the spatial distribution of labor and production within a country, such as Allen and Arkolakis (2014), Coşar and Fajgelbaum (2016), Redding (2016) and Dix-Carneiro and Kovak (2017). Notably, more recent papers have been concerned with quantifying the distributional implications of trade in the presence of domestic friction, as in Fan (2019), Tombe and Zhu (2019), Facchini et al. (2019) and Zi (2020).

Our approach particularly relates to a growing strand of the literature that links trade shocks, migration and regional inequality in the presence of mobility frictions. We build on work by Caliendo et al. (2019) and Tombe and Zhu (2019) to model endogenous domestic migration decisions with between-region migration frictions. Our main departures from these papers is twofold. First, we allow for partial migration of households, i.e. part of the household remains in the region of origin. Second, we introduce inter-regional transfers by migrants to account for the empirical facts regarding remittances qualitatively as well as quantitatively.

Our paper also relates to several other studies that analyse sources of mobility barriers and the implications for employment allocation. For China Brandt et al. (2008) Adamopoulos et al. (2017), Cao and Birchenall (2013) and Ngai et al. (2019) discuss the implications of the *hukou* system as a barrier to labour mobility. These studies highlight that mobility frictions can delay the transition of labour from traditional to new sectors of economic activity. While these papers focus on China in a closed economy setting, we take China's fast growing integration into the global economy via trade into account.

Finally, we highlight two main departures of our paper from the previous literature. First, relative to other other papers mentioned above, we investigate the role of remittances in distributing the benefits of international trade across regions within China. Although remittances play a crucial role in the context of studies analysing international migration, such as Lucas and Stark (1985), Rapoport and Docquier (2006), Rozelle et al. (1999) and Dustmann and Mestres (2010), they have so far been ignored with regard to *domestic* migration. Moreover, we further take into consideration heterogeneous forms of migration by accounting for the empirical observation that migrant households may only partially move to urban areas.

The rest of the paper is structured as follows. Section 2 describes the data. Section 3 presents the stylised facts related to trade, migration and remittances. In section 4 we outline the quantitative model, which we then use in section 5 to to highlight policy implications and counterfactual scenarios. Finally, section 6 concludes.

2 Data and Background

2.1 Data Description

Our empirical analysis uses three different sets of data. The first set of data is the Chinese Household Income Project (CHIP henceforth) data collected and maintained by Beijing Normal University. The CHIPS data is a repeated cross-sectional household survey covering detailed information on household-level income and expenditure of both urban households and rural households in different years. In particular, the CHIPS data also covers detailed information of rural-to-urban migrants, targeting specific industrialised regions where rural-to-urban migrants were most likely to move. We take advantage of the rural-to-migration surveys in 2002, 2007 and 2008 to obtain information about household separation status, household remittance, individual's income, expenditure and hukou status, individual's location and employment status, and other individual and household characteristics. We can therefore characterize how the occurrence and intensity of remittance are related to different household characteristics. We also use the rural household surveys in the same years, which contain migration status, income, and other employment details of each household member, to study how rural household's income vary with migration decisions of its household members.

The second set of data we use is China's population census. Specifically, we use the 2000 census and the 2005 mini-census to obtain current residence, past residence, hukou status, employment status, and other individual characteristics. Therefore, we are able to construct migration share at the regional (province or prefecture) level in these two census years.

The third set of data we use is China's international trade data from 2000 to 2006 collected and maintained by China's General Administration of Customs. It covers the universe of China's export and import transactions in this period at the Harmonized System (HS henceforth) 8-digit level. Using the trade data set, we can calculate export and import value of manufacturing and non-manufacturing goods at the regional level (prefecture or province) for each year during 2000 to 2006. Therefore, combining the trade data with the population census data, we are able to empirically evaluate whether growing exports of manufacturing goods in the urban sector induce rural residents to migrate to these opportunities.

2.2 Background and Definitions

The definition of rural and urban residents is based on the their so called *hukou* status. In China the hukou system is a household registration program that aims at regulating population distribution and rural-to-urban migration. Every Chinese citizen is assigned a hukou status, i.e. either as 'agricultural' (rural) or 'non-agricultural' (urban). A rural hukou allows access to land in an rural area and an urban hukou enables access to housing, schooling, state-sponsored benefits and job opportunities (Wang, 2005; Fan, 2008). Individuals, whose place of residence is different from the hukou location are considered as part of the ”floating” population. In most cases these ”floating” rural-to-urban migrants are separated from their immediate and extended family geographically, and remit a considerable amount of their income to support their family in the rural home town.

Based on the classification of households according to their hukou status, we define the ”floating” rural-to-urban migrants, who move with their entire households as 'complete migrants'. Equivalently, we define households where some members remain in the rural home town as 'partial migrant' households. Table 1 presents the share pf partial migrants in the total rural-urban migration population. According to our classification, partial migration households account for about 37% of migrants in the CHIPS data.

Table 1: Share of partial migrants in total rural-urban migrants

	(1)	(2)	(3)
Year	2002	2007	All
	0.369	0.366	0.367
Observations	1,861	3,741	5,602

3 Stylised Facts

In this section we establish 3 stylised facts related to trade, migration and remittances within China. First, we provide evidence regarding the trade induced rural-urban migration. In the second subsection we provide descriptive and non-parametric statistics on the intensive and extensive margin of remittances among partial and complete migrant households. Third, we investigate the relevance of remittances from the perspective of the rural households, i.e. the recipients of remittances.

3.1 Export-induced Rural-Urban Migration

We first show whether China's export boom in the early 2000s, especially the boom of manufacturing exports, leads rural residents to emigrate. For each prefecture p, we use the 2000 population census and the 2005 mini-census to calculate the fraction of rural residents who move to another prefecture in 2000 and 2005, namely the “emigration share", $m^{e,rural}_{p,2000}$ and $m^{e,rural}_{p,2005}$. We then combine the 2000 population census and the trade data to construct a weighted-average export growth across all possible emigration destinations for rural residents in a particular prefecture p from 2000 to 2005. Specifically, this weighted-average export growth measure, $\Delta EX^{manu,rural}_{p,2005-2000}$, is

$$\Delta EX^{manu,rural}_{p,2005-2000} = \ln\Big(\sum_{d\neq p} m^{e,rural}_{dp,2000} \times \frac{EX^{manu}_{d,2005}}{EX^{manu}_{d,2000}}\Big). \tag{1}$$

$m^{e,rural}_{dp,2000}$ is the fraction of emigrants moving to d among all rural emigrants from prefecture p at the point of the 2000 census. $\frac{EX^{manu}_{d,2005}}{EX^{manu}_{d,2000}}$ measures the manufacturing export growth at an emigration destination d from 2000 to 2005. $\Delta EX^{manu,rural}_{p,2005-2000}$ thus measures the manufacturing export growth a rural resident in p faces across all his/her possible emigration destinations d, weighted by the emigration probabilities to these different destinations. We leave out the local prefecture p in the construction of $\Delta EX^{manu,rural}_{p,2005-2000}$ to capture the "pulling-out" effect of export growth outside of p.

Intuitively, we assume that emigration probabilities across different destinations are persistent across years, so a rural resident responds more actively to export growth in a prefecture where he/she is more likely to move.

To investigate how export growth in emigration destinations affects the emigration probability of rural residents, we adopt the following empirical specification:

$$\Delta m^{e,rural}_{p,2005-2000} = \beta \times \Delta EX^{manu,rural}_{p,2005-2000} + X_{pt} + \epsilon_{pt}, \tag{2}$$

where the outcome variable $\Delta m^{e,rural}_{p,2005-2000} = \ln \frac{\Delta m^{e,rural}_{p,2005}}{\Delta m^{e,rural}_{p,2000}}$ measures the log change in emigration probability of rural residents in prefecture p from 2000 to 2005. X_{pt} includes a set of time-varying control variables. We thus exploit the variation of overtime changes $\Delta EX^{manu,rural}_{p,2005-2000}$ across different prefectures to identify β. In Figure 1, we plot $\Delta m^{e,rural}_{p,2005-2000}$ against $\Delta EX^{manu,rural}_{p,2005-2000}$ to visualize the relationship. Clearly, a larger weighted-average export growth in emigration destinations is associated with an increased likelihood of rural residents' emigration probability.

Table 2 reports the estimation results of (2). As shown in column (1), a doubling of manufacturing exports at the emigration destinations outside of p causes an increase of 24.6% in the emigration probability among rural residents in p. In column (2), we

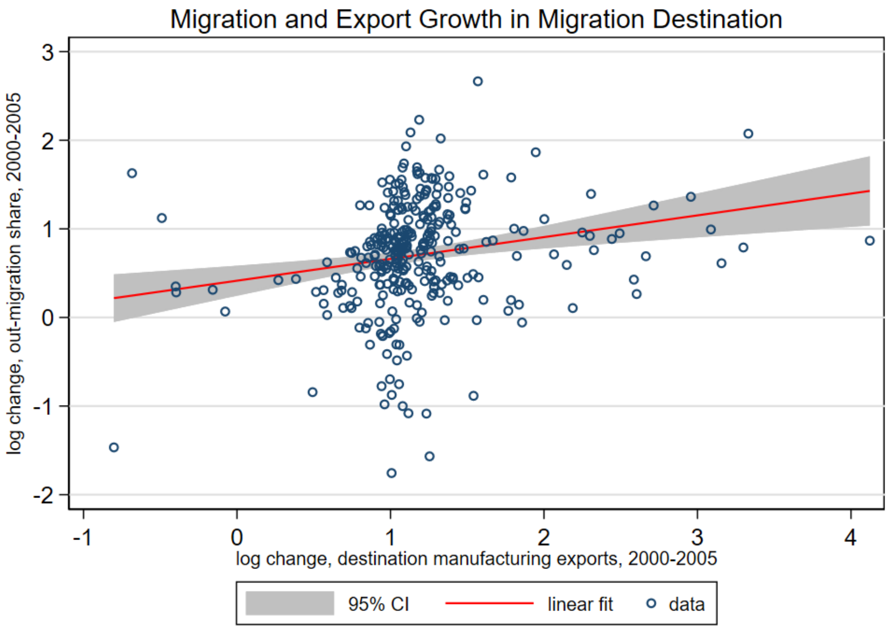

Figure 1: Emigration and Export Growth in Emigration Destination

construct a weighted-average manufacturing import growth measure $\Delta IM^{manu,rural}_{p,2005-2000}$ similar to (1) and include it as a control variable. We also control for the export and import growth of manufacturing goods in the local prefecture p. The estimate of β remain stable and statistically significant at the 5% level. In column (3), we additionally control for the weighted-average non-manufacturing export growth at the emigration destinations[1], as well as the non-manufacturing export growth at the local prefecture p. The economic and statistical significance of β remains almost unchanged. Finally, we investigate whether this "pulling-out" effect also applies to urban residents. We estimate the specification in column (3) for urban residents and find that economic effect is almost halved and the coefficient of $EX^{manu,urban}_{p,2005-2000}$ becomes statistically insignificant at the 10% level. Therefore, the "pulling-out" effect of manufacturing export boom induces only rural residents to emigrate.

[1] This measure is constructed by replacing $\frac{EX^{manu}_{d,2005}}{EX^{manu}_{d,2000}}$ in (1) with $\frac{EX^{non-manu}_{d,2005}}{EX^{non-manu}_{d,2000}}$, the non-manufacturing export growth in prefecture d.

Table 2: Migration and destination export growth

	(1)	(2)	(3)	(4)
	log change of emigration probability			
$\Delta EX^{manu,rural}_{p,2005-2000}$	0.246***	0.226**	0.223**	
	(0.072)	(0.094)	(0.095)	
$\Delta IM^{manu,rural}_{p,2005-2000}$		-0.029	-0.023	
		(0.118)	(0.117)	
$\Delta EX^{manu,urban}_{p,2005-2000}$				0.141
				(0.119)
$\Delta IM^{manu,urban}_{p,2005-2000}$				-0.011
				(0.084)
Individual type	Rural	Rural	Rural	Urban
Control for local manu. trade	No	Yes	Yes	Yes
Control for non-manu. export	No	No	Yes	Yes
R-squared	0.042	0.038	0.042	0.018
Observations	311	256	254	255

Note: Robust standard errors in parentheses. *, ** and *** indicate significance at 10%, 5% and 1% levels.

3.2 Migration and Remittances

3.2.1 Descriptive and non-parametric statistics

Complete vs partial migration and remittances

Table 3 refers to the extensive margin of migrants' remittances among partial and complete migrant households, captured by the (unconditional) probability of positive remittance for the two available cross-sections. The Table shows that regardless of the migration type, the majority of all migrant households (58%) remit a share of their income. Notably, partial migrants are more likely to remit than complete migrants across both years. While, on average about 71% of partial migrants send remittances, among the complete migrants it is about 50% of the households. Although the share of complete migrant households sending remittances increases from 39% in 2002 to 55% in 2007, the equivalent figures for partial migrants remain relatively stable over time, i.e. a decrease from 73% in 2002 to 70% in 2007. Note, that since the data does not allow to identify the same household overtime, it is not clear whether these developments are due to a change of composition within the migrants' types. In other words,

Table 3: Probability of positive remittance by migration type

	(1)	(2)	(3)
Year	2002	2007	All
Complete migration	0.390	0.551	0.497
	(0.488)	(0.498)	(0.500)
Partial migration	0.727	0.701	0.709
	(0.446)	(0.458)	(0.454)
Total	0.514	0.605	0.575
	(0.500)	(0.489)	(0.494)
Observations	1,861	3,741	5,602

Note: Standard deviations in parentheses.

it is not clear whether between 2002 and 2007 more of the existing complete migrant households started to remit or whether there are now 'new' complete migrants that chose to remit.

Figure 8 below shows the intensive margin of migrants' remittances across the different migration types in 2002 and 2007 respectively.[2] Here, the intensive margin of migrants' remittances is illustrated by the kernel density of remittances as a share of income conditional on households reporting positive remittances.
The figure suggests that partial migrants remit a greater share of their income than complete migrant households. On average, partial migrants remit about 24% of their income, while complete migrants only send back 14% of their household income. Over time, both partial and complete migrant households increased the share of income that was being remitted: for partial migrants the the mean value rose from about 20% to 25% in 2007. Similarly, within the same time period complete migrants increased remittances as a share of income by about 5%- points from 10% to 15% .

Remittance and partial migration: Across cities

3.2.2 Empirical estimation

Previous tables and figures are indicative that partial migrants are more likely to send remittances than complete migrants. Moreover, the descriptive statistics suggest that partial migrants tend to remit more. In order to test these two hypotheses, we run the following regression on the household level:

[2] See also Table 9 and 10 in the Appendix.

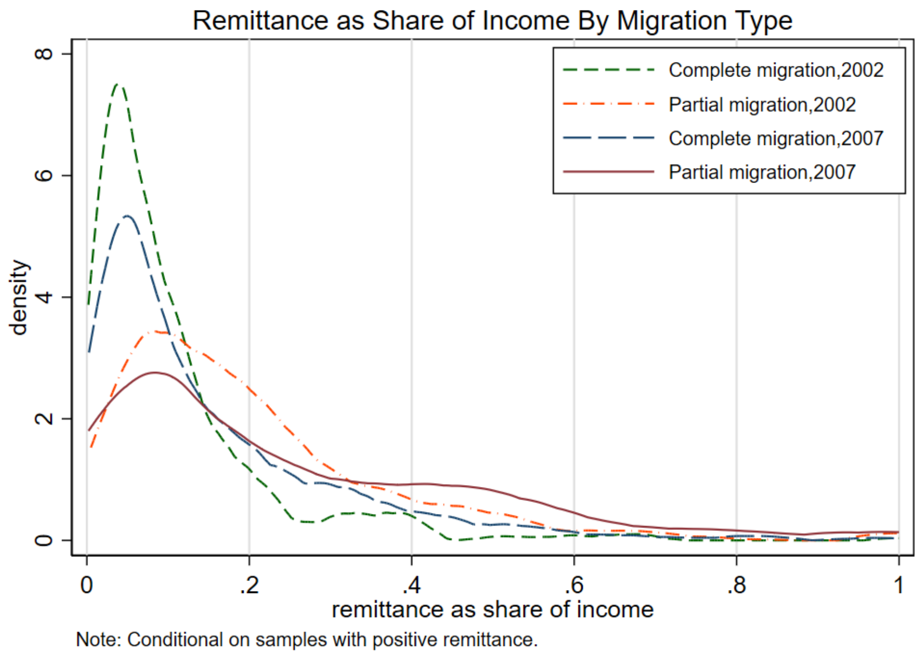

Figure 2: Distribution of Remittance Intensity by Migration Type

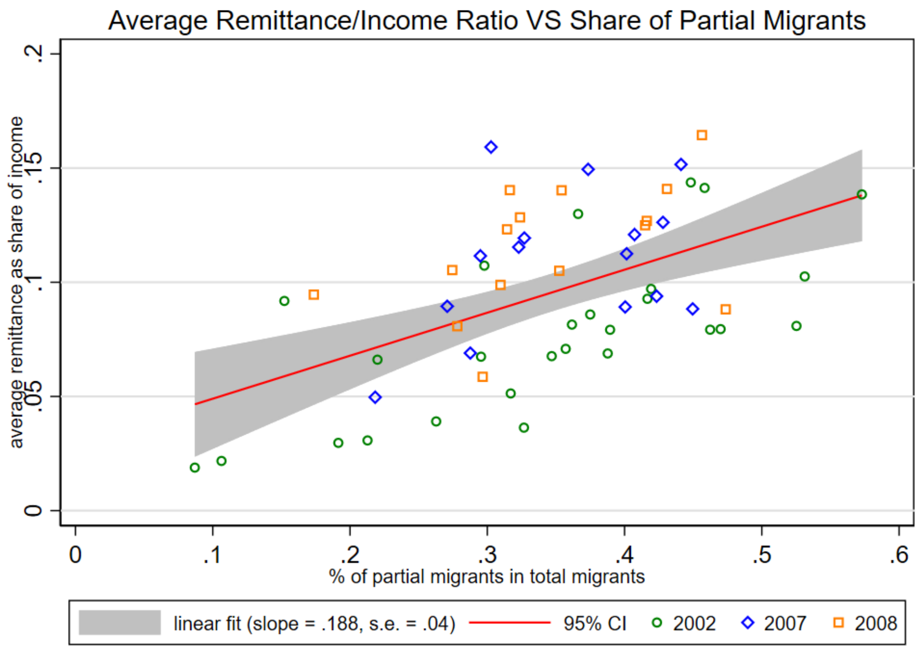

Figure 3: Remittance and Partial Migration: Across Cities

$$y_{it} = \delta_{cst} + X_i'\beta + v_{it} \quad (3)$$

where index i indicates the household and t the relevant year. The dependent variable of interest is denoted as y, representing either the extensive margin or the intensive margin of remittances. The former variable is captured by $\mathbf{1}(R > 0)$, which is an indicator dummy for whether the migrant household sends remittances. For the intensive margin we consider the following two measures: first, remittances relative to household income R/I and second, remittances relative to aggregate household expenditure E/I. City-sector-year fixed effects are denoted by δ_{cst}. Furthermore, we control for observable household characteristics denoted by the vector X_i, which includes the size of the household and the hukou status.[3] Lastly, the residual is denoted by v_{it}.

Table 4: Intensive & extensive Margin of remittances by migration type

	(1)	(2)	(3)	(4)	(5)
Dependent var:	$\mathbf{1}(R > 0)$	R/I	R/I	R/E	R/E
Partial migration	0.189***	0.093***	0.095***	0.109***	0.105***
	(0.011)	(0.004)	(0.006)	(0.005)	(0.006)
Mean of y	0.596	0.109	0.183	0.129	0.217
City-sector-year FE	Yes	Yes	Yes	Yes	Yes
Houshold observables	Yes	Yes	Yes	Yes	Yes
Drop 0 remittance	No	No	Yes	No	Yes
Within R-squared	0.036	0.073	0.067	0.080	0.071
Observations	8,084	8,083	4,821	8,084	4,821

Note: Robust standard errors in parentheses. *, ** and *** indicate significance at 10%, 5% and 1% levels.

Table 4 summarises the estimation results of equation (3). The first specification is related to the extensive margin of remittances. Here, the coefficient of the partial migration dummy variable takes a value of 0.189 and is statistically significant at the 1% level. The positive coefficient indicates that partial migrants are more likely to send remittances than complete migrants.

Specifications (2)–(5) are related to the intensive margin of remittances. In specification (2) and (3) the dependent variable of interest is the remittance relative to household income R/I, where in (3) we drop households that report 0 remittances. The

[3] In the robustness check in the Appendix we include further observables of the household head to proxy for additional household characteristics. We here consider the gender, marriage status (single or married), age bin and education of the household head.

coefficients take a value of 0.093 and 0.095 respectively and are both statistically significant at the 1% level. Thus, these estimation results confirm that partial migrants tend to remit a larger proportion of their income than complete migrants. Similarly, in specification (4) and (5) we show that remittances relative to total household expenditure also tend to be larger among partial migrants. Here, the coefficients in (4) is equal to 0.109 and in (5), where we drop observations that do not report any positive remittances, the equivalent coefficient is 0.105.

3.3 Relevance of Partial Migration and Remittances for Rural Households

To validate the importance of remittances for the households in the rural areas, we will follow the above approach and investigate the magnitude and intensity of remittances based on the CHIPS 2002 and 2007 surveys for rural households. Note that here only information on partial migration is available. This is due to the way complete migration is defined, i.e. the entire household relocated to an urban region.

Table 5: Probability and intensity of having migrants in rural households

	(1)	(2)	(3)
Year	2002	2007	All
% of HH with out-of-county migrant workers	0.272	0.352	0.309
Observations	9,195	8,000	17,195
% of migrant within HH, cond. on + migrants	0.309	0.365	0.339
	(0.127)	(0.147)	(0.141)
Observations	2,502	2,814	5,316

Note: Standard deviations in parentheses.

Table (5) reports the unconditional probability of a rural household being classified as 'partial migrants', i.e. at least one member of the household lives in an urban area. Across the two cross-sections, on average 31% of the households can be classified as migrant household, where about 34% of the household members live outside of the home county.

Table 6: Household income and migrants

	(1)	(2)	(3)
	Total	2002	2007
Dependent var:	log household net income		
1(out-of-county migrants)	0.075***	0.126***	0.026*
	(0.010)	(0.013)	(0.014)
County-year FE	Yes	Yes	Yes
Household-size FE	Yes	Yes	Yes
Within R-squared	0.003	0.009	0.000
Observations	17,161	9,189	7,972

Note: Robust standard errors in parentheses. *, ** and *** indicate significance at 10%, 5% and 1% levels.

Table 6 and 7 shed light on the significance of rural-urban connections within a household for household income. First, Table 6 presents the result of a simple regression where the dependent variable is the log of the household's net income and the independent variables are a indicator for whether any of the household members live in another county, county-year fixed effects and the size of the household. As shown, migrant households seem to have on average higher income than households without migrants. Next, Table 7 captures the within household migrant intensity. The positive and significant coefficient(s) indicate that households with more migrants earn, on average, more income than non-migrant households.

Table 7: Household income and migrant intensity

	(1)	(2)	(3)	(4)	(5)	(6)
	Total	2002	2007	Total	2002	2007
Dependent var:	log household net income					
% of migrant	0.243***	0.432***	0.118***	0.359***	0.546***	0.259***
	(0.025)	(0.039)	(0.032)	(0.050)	(0.082)	(0.064)
County-year FE	Yes	Yes	Yes	Yes	Yes	Yes
HH-size FE	Yes	Yes	Yes	Yes	Yes	Yes
Drop 0 migrant	No	No	No	Yes	Yes	Yes
Within R-sq	0.005	0.012	0.001	0.010	0.019	0.006
Observations	17,161	9,189	7,972	5,313	2,501	2,812

Note: Robust standard errors in parentheses. *, ** and *** indicate significance at 10%, 5% and 1% levels.

4 Quantitative Model

Our general equilibrium model of migration and trade builds on work by Caliendo et al. (2019) and Tombe and Zhu (2019). The model features a tradable and non-tradable sector and multiple regions of China between which goods and labor may flow. Specifically, we model between-region migration frictions and within-region rural-to-urban migration similarly to Tombe and Zhu (2019).

Our main departures from these papers is twofold. First, we allow for partial migration of households, i.e. part of the household remains in the region of origin. Second, we introduce inter-regional transfers by migrants to account for the empirical facts regarding remittances qualitatively as well as quantitatively.

4.1 Households

4.1.1 Preferences

We assume that each household has the following generalized constant-elasticity-of-substitution (CES) preference following Jung et al. (2019):

$$U = [\sum_s (q^s + \overline{q})^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}}; \;\; s = X, Y, \tag{4}$$

where the subscript X stands for tradable consumption goods and Y stands for the non-tradable service good. The curviture is determined by the parameter $\sigma \geq 1$ and $\overline{q} > 0$ is a preference parameter. Each household's budget constraint is $\sum_s p^s \cdot q^s = w$. It then follows that a household's demand for sector s is given by

$$q^s = \frac{w + \overline{P}\overline{q}}{P^{1-\sigma}}(p^s)^{-\sigma} - \overline{q}, \tag{5}$$

where $P^{1-\sigma} = \sum_s p^{s1-\sigma}$ is the CES price index, and $\overline{P} = \sum_s p^s$ is the "average price".

We denote the a household's expenditure on sector s's goods as $x^s = p^s \cdot q^s$.The share of expenditure that a household spends on good s, β^s, then takes the following form:

$$\beta^s = \left(\frac{p^s}{P}\right)^{1-\sigma} + \frac{\overline{P}\overline{q}}{w}\left(\frac{p^s}{P}\right)^{1-\sigma}[1 - \frac{p^s/\overline{P}}{(p^s/P)^{1-\sigma}}]. \tag{6}$$

From this expression we can see that the household preferences in (4) imply non-homotheticity, i.e. a household increases its expenditure share on the more expensive sector and goods as its income rises.[4] Note that for $\overline{q} = 0$, we have the standard CES

[4] See proof in Appendix.

demand function.

4.1.2 Migration Decision

Each household is indexed by o, indicating its origin. In the context of China, o also stands for a household's location of Hukou registration, in which the household is treated as local resident and therefore has full access to the non-tradable public service in that location. A household can choose to move or relocate to other locations. The moving decision involves two margins. First, the household chooses the destination of moving, indicated by the subscript d. This formulation is common within the literature of trade and migration (see e.g. Tombe and Zhu (2019) and Caliendo et al. (2019)). Second, the household also chooses between two modes of migration indexed by the superscript m: complete migration or partial migration.

When deciding where and how to move, a household maximises the following utility:

$$\max_{d,m}\{\log(U_{do}^m) - \delta_{do}^m + \nu \cdot \epsilon_d^m\} \quad m = C, P \tag{7}$$

where the superscript C indicates complete migration and P partial migration respectively. Furthermore, δ_{do}^m captures the cost of moving, which is also specific to a particular type of migration and the idiosyncratic shock ϵ_d^m is a preference term, which is randomly drawn from a probabilistic distribution. As in Caliendo et al. (2019), ν scales the variance of the idiosyncratic shock.

We assume that $\{\epsilon_d^m\}$ follows a Generalized Extreme Value distribution:

$$F(\epsilon_d^m) = \exp(-\sum_d[\sum_m \exp(-\frac{\epsilon_d^m}{\kappa})]^\kappa). \tag{8}$$

Such a distribution assumption features the following properties. First, we allow a nested structure such that the preference shocks ϵ. associated with the same destination d but different migration mode m, are correlated and the correlation is given by $1-\kappa^2$. Second, the preference shocks associated with different moving destinations are independently drawn. Third, we assume that when $d = o$, m only takes one value rather than $\{C, P\}$, since the notion of "complete migration" and "partial migration" becomes obsolete when the household decides to stay in o.

To reduce notation, we further define $V_{do}^m = \log(U_{do}^m) - \delta_{do}^m$. Given our distribution assumption in (8), the moving probability μ_{do}^m by migration type m is given by the following expression:

$$\mu_{do}^{m} = \mu_{do} \times \mu^{m|do} \tag{9}$$

where

$$\mu_{do} = \frac{[\sum_m \exp\left(\frac{V_{do}^m}{\nu\kappa}\right)]^{\kappa}}{\sum_k [\sum_m \exp\left(\frac{V_{ko}^m}{\nu\kappa}\right)]^{\kappa}} \tag{9a}$$

$$\mu^{m|do} = \frac{\exp\left(\frac{V_{do}^m}{\nu\kappa}\right)}{\sum_h \exp\left(\frac{V_{do}^h}{\nu\kappa}\right)},\ d \neq o \tag{9b}$$

$$\mu^{m|do} = 1,\ d = o. \tag{9c}$$

Here, μ_{do} is the probability that a household moves from o to d using any migration modes, and $\mu^{m|do}$ is the probability of choosing migration mode m conditional on the household moving from o to d.

Hence, compared to Caliendo et al. (2019) and Tombe and Zhu (2019) , our modelling of migration decisions offers two novelties. First, we allow households to choose not only where to migrate to, but also how to migrate. These migration options differ in their costs and benefits. Second, our nested structure also allows the idiosyncratic shocks to be correlated within one migration destination. Contrary to us, these idiosyncratic shocks are assumed to be independently drawn in Caliendo et al. (2019) and Tombe and Zhu (2019) even within the same migration destination.

4.1.3 Remittances

In line with empirical evidence, migrants send remittances to provide economic support to individuals in the origin village.[5] Remittances here have the nature of financing consumption of either the non-tradable public good or the tradable consumption good. Note that both, complete and partial migrants may remit a share of their income earned in urban. Recall, however, that the consumption of the public good is tied to the household's location of Hukou registration. It then follows that urban-rural remittances within a household are given by

$$R_{do}^{m} = w_d\left[(1-\alpha)\beta_{do}^{m,X} + (1-\beta_{do}^{m,X})\right] = w_d\left[1 - \alpha\beta_{do}^{m,X}\right] \tag{10}$$

[5] insert reference

where $\beta_{do}^{m,X}$ represents the expenditure share on the tradable consumption good and α indicates how much of the consumption good of a partial migration household is consumed in the destination location.

Next, we can express remittances as a share of household income :

$$\frac{R_{do}^{m}}{w_d} = \left[1 - \alpha\beta_{do}^{m,X}\right] \tag{11}$$

and similarly, we can find an expression for remittances as a share of expenditure denoted by

$$\frac{R_{do}^{m}}{E_d} = \frac{\left[1 - \alpha\beta_{o}^{m,X}\right]}{\alpha\beta_{d}^{m,X}} \tag{12}$$

where here E_d captures expenditure of the part of the household living in the urban region.

4.2 Production, Trade and Prices

4.2.1 Production Technology

Labour demand stems from the production of sectoral goods.The technology to produce these sectoral goods Q requires labour L and materials M, which consist of goods from all sectors. In doing so, we allow for input-output linkages within and across regions. It then follows that the production function of a producer of variety ω^s located in d and operating in sector s is given by

$$Q_d^s(\omega^s) = z_d^s(\omega^s) \cdot L_d^s(\omega^s)^{\gamma^s} \cdot \Pi_n[M_d^{n,s}(\omega^s)]^{\gamma^{n,s}} \tag{13}$$

where $Q_d^s(\omega^s)$ denotes output quantity, $M_d^{n,s}(\omega^s)$ denotes the amount of required input produced by sector-n, and $L_d^s(\omega^s)$ denotes the amount of labor used in the production. The parameter $\gamma^s \geq 0$ captures the share in value added in the production of sector s. $\gamma^{n,s}$ captures the intensity at which sector-s relies on goods produced by sector-n as input. The production technology is assumed to be constant-return-to-scale, so $\gamma^s + \sum_n \gamma^{n,s} = 1$.

$z_d^s(\omega^s)$ denotes the total factor productivity of producing variety ω^s in region d. Following Eaton and Kortum (2002), we assume that $z_d^s(\omega^s)$ is drawn from a Fréchet distribution $G_d^s(z)$:

$$G_d^s(z) = \exp\left[-T_d^s \cdot z^{-\theta^s}\right],$$

where T_d^s captures the average productivity or the "absolution advantage" of region d in sector s, and θ^s captures the productivity dispersion or the strength of "comparative advantage".

Meanwhile, in region d, for each sector s, the varieties being demanded across all possible origins are aggregated in the following CES format to sectoral goods:

$$\tilde{Q}_d^s = \left[\int_0^1 \tilde{q}_d^s(\omega^s)^{\frac{\rho^s-1}{\rho^s}} d\omega^s\right]^{\frac{\rho^s}{\rho^s-1}}$$

where $\tilde{q}_d^s(\omega^s)$ is the amount of varieties ω^s demanded in region d.

The sectoral good $\tilde{Q}_d^s$ is either consumed directly by households as final consumption or used as intermediate inputs by perfectly competitive producers of differentiated varieties. These varieties use labour and intermediate inputs with constant-return-to-scale Cobb-Douglas technologies, which yields the following cost index c of an input from region o, employed in sector s:

$$c_o^s = \Pi_n\left(\frac{P_d^n}{\gamma^{n,s}}\right)^{\gamma^{n,s}} \cdot \left(\frac{w_d}{\gamma^s}\right)^{\gamma^s} \tag{14}$$

where w_d is the wage rate in a region and P_d^n is the price of an intermediate input from sector n, which also denotes the price of the final good $\tilde{Q}_d^n$.

4.2.2 Trade and Prices

We follow Eaton and Kortum (2002) to derive the share of expenditure π that a region d spends on goods produced by o at sector s:

$$\pi_{do}^s = \frac{T_o^s(c_o^s \cdot \tau_{do}^s)^{-\theta^s}}{\sum_o T_o^s(c_o^s \cdot \tau_{do}^s)^{-\theta^s}} \tag{15}$$

where $\tau_{do}^s \geq 1$ denotes iceberg costs that a producer incurs to ship one unit of a good from region o to arrive in destination d. If a good is nontradable, then $\tau = \infty$. It then follows that the aggregate price index of sector s in destination d is given by

$$P_d^s = \Gamma^s \cdot [\sum_o T_o^s (c_o^s \cdot \tau_{do}^s)^{-\theta^s}]^{-\frac{1}{\theta^s}} \tag{16}$$

where $\Gamma^s = \Gamma(\frac{\theta^s+1-\rho^s}{\theta^s})^{\frac{1}{1-\rho^s}}$ is a constant.

4.3 Equilibrium

4.3.1 Description

In equilibrium the household takes prices and wages as given and maximises its utility by optimally choosing whether and where to migrate to, given the current migration frictions. Households further allocate their labour endowment between the sectors to generate income and use their labour income to purchase the utility maximising bundle of goods.

Firms maximise profits using labour and intermediate inputs subject to the cost of buying inputs and paying labour its wage. While a firm will hire from the local labour market, which is defined by the region d it is located in, it optimally decides where to buy its intermediate inputs from: locally, from other regions or from abroad.

The equilibrium will then consist of a distribution of prices, wages, employment and migration types, such that goods and labour markets clear.

4.3.2 Solution

Labour Market. The Labour market clearing condition implies that labour demand matches labour supply:

$$L_d = \sum_m \sum_o \mu_{do}^m \times \overline{L}_o \tag{17}$$

where $\overline{L}_o$ is the initial population stock at each location o, which also defines the labour supply for all sectors in d.

The wage bill paid to labor working in sector s in region d is as follows,

$$w_d \cdot L_d = \sum_s \gamma^s \cdot Y_d^s, \tag{18}$$

where $Y_d^s = P_d^s \cdot \tilde{Q}_d^s$ is the gross output value of sector s in d.

Goods Market Goods market clearing implies that a set of prices and quantities exist, such that supply matches demand. From equation (13) and (16), we can find the total output value of location o in sector s:

$$Y_o^s = \sum_d \pi_{do}^s \cdot X_d^s \tag{19}$$

where X_d^s is the total expenditure that d spends on sector s's goods.

Sectoral Expenditure A region's expenditure on a certain sector s, X_d^s, consists of two components: 1) spending of producers to purchase intermediate inputs; 2) final consumption spending of households

$$X_d^s = \sum_n \gamma^{s,n} \cdot Y_d^n + F_d^s, \tag{20}$$

where $\sum_n \gamma^{s,n} \cdot Y_d^n$ is the intermediate demand and F_d^s is the final consumption demand by households.

For a particular region d (urban or rural), final consumption demand for consumption goods ($s = X$) is:

$$\begin{aligned} F_d^X = & \underbrace{\alpha \cdot w_d(\sum_{j \neq d} \beta_{dj}^{p,X} \cdot \mu_{dj}^p \cdot \overline{L}_j) +}_{\text{partial migration consumption}} \quad \underbrace{w_d \cdot \sum_{j \neq d} \beta_{dj}^{c,X} \cdot \mu_{dj}^c \cdot \overline{L}_j}_{\text{complete migration consumption}} \quad + \underbrace{\beta_{dd}^{c,X} \cdot \mu_{dd} \cdot w_d \cdot \overline{L}_d}_{\text{stayers consumption}} \\ & \underbrace{+ (1-\alpha) \sum_{k \neq d} [\beta_{kd}^{p,X} \cdot w_k \cdot \mu_{kd}^p \cdot \overline{L}_k]}_{\text{partial migration consumption}} \end{aligned} \tag{21}$$

Welfare. Given equilibrium prices and wages, we can now derive the welfare function from (5) by denoting that the indirect utility for a household with income w is given by

$$U_{do}^m = \frac{w_d + \overline{P_{do}^m} \overline{q}}{P_{do}^m}. \tag{22}$$

where, P is the aggregate price index and $\overline{P}$ the average price between the consumption and service good. This expression represents welfare conditional on the moving decision. In order to take into account how households' moving options affect welfare, similar to Caliendo et al. (2019), we will now consider the *ex ante* expected welfare of a household from region o, before the idiosyncratic shocks s are realized:

$$\overline{V}_o = E[U^m_{do} - \delta^m_{do} + \nu \cdot \epsilon^m_d \mid d, m]$$

which is also the expected utility of moving from o to d using migration mode m. Utility maximization ensures that the expected utility is equal across all potential d and m, a non-arbitrage result from the perspective of optimal location choice. Applying the property of the Generalized Extreme Value distribution yields the following expression

$$\overline{V}_o = \nu \ln \Big[\sum_k (\sum_m \exp{(\frac{V^m_{ko}}{\nu\kappa})})^\kappa \Big] \tag{23}$$

Intuitively, the expected (or average) utility of a household from region o is the sum of the utility levels of all possible migration options, discounted by the friction associated with each option $\{d, m\}$. The expected utility $\overline{V}_o$ differs across o because U^m_{do} and δ^m_{do} can vary depending on which region o the household is from.

5 Policy Implications

To illustrate the quantitative importance of the mechanism we propose, we conduct a bilateral trade-shock as counterfactual exercise and plot the changes in migration shares, remittances and wages. In order to do so, we conceptualize the general equilibrium in a stylized world where the key mechanism is preserved without loss of generality. Specifically, we assume that the world consists of only one consumption sector and three regions, namely urban China U, rural China R, and rest of the world F. We further simplify by assuming that the only feasible migration direction is moving from rural China to urban China. We also remove non-homotheticity by setting $\overline{q} = 0$.

Migration decision: The probability of moving from R to U using a particular migration mode m is:

$$\mu^m_{UR} = \mu_{UR} \times \mu^{m|UR} \tag{24}$$

where

$$\mu_{UR} = \frac{[\exp(\frac{V^p_{UR}}{\nu\kappa}) + \exp(\frac{V^c_{UR}}{\nu\kappa})]^\kappa}{[\exp(\frac{V^p_{UR}}{\nu\kappa}) + \exp(\frac{V^c_{UR}}{\nu\kappa})]^\kappa + \exp(\frac{V_{RR}}{\nu\kappa})^\kappa}, \quad \mu_{RR} = 1 - \mu_{UR}, \tag{24a}$$

$$\mu^{c|UR} = \frac{\exp(\frac{V^c_{UR}}{\nu\kappa})}{\exp(\frac{V^c_{UR}}{\nu\kappa}) + \exp(\frac{V^p_{UR}}{\nu\kappa})}, \quad \mu^{p|UR} = 1 - \mu^{c|UR}. \tag{24b}$$

$$\tag{24c}$$

where

$$V^c_{UR} = \log(\frac{w_U}{P_U}) - \delta^c_{UR}, \quad V^p_{UR} = \log(\frac{w_U}{P^\alpha_U P^{1-\alpha}_R}) - \delta^p_{UR}, \quad V_{RR} = \log(\frac{w_R}{P_R}) - \delta_{RR}.$$

According to our simplified assumptions, $\mu_{UU} = \mu_{FF} = 1$, so $\mu_{RU} = \mu_{FU} = \mu_{FR} = \mu_{UF} = \mu_{RF} = 0$. This is equivalent to assuming that $\delta_{RU} = \delta_{FU} = \delta_{FR} = \delta_{UF} = \delta_{RF} = \infty$.

Labor market clearing: Labor supply

$$L_U = \overline{L}_U + \mu_{UR} \cdot \overline{L}_R, \quad L_R = \mu_{RR} \cdot \overline{L}_R, \quad L_F = \overline{L}_F. \tag{25}$$

With labor being the only production factor:

$$w_d \cdot L_d = Y_d, \tag{26}$$

Goods market clearing: Total output (sales) of region o:

$$Y_o = \sum_d \pi_{do} \cdot X_d \tag{27}$$

where gravity implies

$$\pi_{do} = \frac{T_o(w_o \cdot \tau_{do})^{-\theta}}{\sum_o T_o(w_o \cdot \tau_{do})^{-\theta}} \tag{28}$$

and the price is

$$P_d = \Gamma \cdot [\sum_o T_o(w_o \cdot \tau_{do})^{-\theta}]^{-\frac{1}{\theta}} \tag{29}$$

Expenditure: A region's expenditure now only consists of final consumption:

$$\begin{aligned}
X_U &= (\mu^p_{UR} \cdot \alpha + \mu^c_{UR}) w_U \cdot \overline{L}_R + w_U \cdot \overline{L}_U, \\
X_R &= [\mu_{RR} \cdot w_R + \mu^p_{UR}(1-\alpha) w_U] \overline{L}_R, \\
X_F &= w_F \cdot \overline{L}_F.
\end{aligned} \tag{30}$$

Note that migration shifts part of the expenditure from rural to urban. The share of remittance relative to wage income, in such a stylized setup, is:

$$\frac{R^m_{do}}{w_d} = 1 - \alpha. \tag{31}$$

Solving Equilibrium in Relative Changes

To study the implications of China's trade opening towards the rest of the world for migration and welfare, we follow Caliendo et al. (2019) to analyze the equilibrium in relative changes (or in "exact hat"). We define a "hat" variable of x as $\hat{x} = \frac{x'}{x}$, where x denotes the initial value in the equilibrium, and x' denotes the "new" value after some shocks take place. The shocks that we are interested in are $\hat{\tau}_{FU} < 1$ and $\hat{\tau}_{UF} < 1$, namely the costs of selling from urban China to abroad and selling from abroad to urban China both decrease.

Upon this change, the changes in trade share and price index are:

$$\hat{\pi}_{do} = \frac{(\hat{w}_o \cdot \hat{\tau}_{do})^{-\theta}}{\sum_o \pi_{do}(\hat{w}_o \cdot \hat{\tau}_{do})^{-\theta}} \tag{32}$$

$$\hat{P}_d = [\sum_o \pi_{do}(\hat{w}_o \cdot \hat{\tau}_{do})^{-\theta}]^{-\frac{1}{\theta}} \tag{33}$$

Turning to the migration decisions, we have

$$
\begin{aligned}
\hat{\mu}_{UR} &= \frac{[\mu^{p|UR}(\frac{\hat{w}_U}{\hat{P}_U^{\alpha}\hat{P}_R^{1-\alpha}})^{\frac{1}{\nu\kappa}} + \mu^{c|UR}(\frac{\hat{w}_U}{\hat{P}_U})^{\frac{1}{\nu\kappa}}]^{\kappa}}{\mu_{UR}[\mu^{p|UR}(\frac{\hat{w}_U}{\hat{P}_U^{\alpha}\hat{P}_R^{1-\alpha}})^{\frac{1}{\nu\kappa}} + \mu^{c|UR}(\frac{\hat{w}_U}{\hat{P}_U})^{\frac{1}{\nu\kappa}}]^{\kappa} + \mu_{RR}(\frac{\hat{w}_R}{\hat{P}_R})^{\frac{1}{\nu}}} \\
\hat{\mu}_{RR} &= \frac{(\frac{\hat{w}_R}{\hat{P}_R})^{\frac{1}{\nu}}}{\mu_{UR}[\mu^{p|UR}(\frac{\hat{w}_U}{\hat{P}_U^{\alpha}\hat{P}_R^{1-\alpha}})^{\frac{1}{\nu\kappa}} + \mu^{c|UR}(\frac{\hat{w}_U}{\hat{P}_U})^{\frac{1}{\nu\kappa}}]^{\kappa} + \mu_{RR}(\frac{\hat{w}_R}{\hat{P}_R})^{\frac{1}{\nu}}} \\
\hat{\mu}^{c|UR} &= \frac{(\frac{\hat{w}_U}{\hat{P}_U})^{\frac{1}{\nu\kappa}}}{\mu^{c|UR}(\frac{\hat{w}_U}{\hat{P}_U^{\alpha}})^{\frac{1}{\nu\kappa}} + \mu^{p|UR}(\frac{\hat{w}_U}{\hat{P}_U^{\alpha}\hat{P}_R^{1-\alpha}})^{\frac{1}{\nu\kappa}}} \\
\hat{\mu}^{p|UR} &= \frac{(\frac{\hat{w}_U}{\hat{P}_U^{\alpha}\hat{P}_R^{1-\alpha}})^{\frac{1}{\nu\kappa}}}{\mu^{c|UR}(\frac{\hat{w}_U}{\hat{P}_U^{\alpha}})^{\frac{1}{\nu\kappa}} + \mu^{p|UR}(\frac{\hat{w}_U}{\hat{P}_U^{\alpha}\hat{P}_R^{1-\alpha}})^{\frac{1}{\nu\kappa}}}
\end{aligned}
\tag{34}
$$

Finally, we combine the goods market clearing condition and the labor market clearing condition, both in "hat":

$$
\hat{w}_o \cdot \hat{L}_o(w_o \cdot L_o) = \sum_d \hat{\pi}_{do} \cdot \pi_{do} \cdot \hat{X}_d \cdot X_d \tag{35}
$$

where the "new" labor supply upon trade shock is

$$
\hat{L}_U \cdot L_U = \overline{L}_U + \hat{\mu}_{UR} \cdot \mu_{UR} \cdot \overline{L}_R, \;\; \hat{L}_R \cdot L_R = \hat{\mu}_{RR} \cdot \mu_{RR} \cdot \overline{L}_R, \;\; L_F' = L_F = \overline{L}_F \tag{36}
$$

and the "new" expenditure is

$$
\begin{aligned}
\hat{X}_U \cdot X_U &= (\hat{\mu}^p_{UR} \cdot \mu^p_{UR} \cdot \alpha + \hat{\mu}^c_{UR} \cdot \mu^c_{UR})\hat{w}_U \cdot w_U \cdot \overline{L}_R + \hat{w}_U \cdot w_U \cdot \overline{L}_U, \\
\hat{X}_R \cdot X_R &= [\hat{\mu}_{RR} \cdot \mu_{RR} \cdot \hat{w}_R \cdot w_R + \hat{\mu}^p_{UR} \cdot \mu^p_{UR}(1-\alpha)\hat{w}_U \cdot w_U]\overline{L}_R, \\
\hat{X}_F \cdot X_F &= \hat{w}_F \cdot w_F \cdot \overline{L}_F.
\end{aligned}
\tag{37}
$$

Therefore, given the initial value of endogenous variables in the equilibrium $\{\pi_{do}\}$, $\{\mu_{UR}, \mu_{RR}, \mu^{c|UR}, \mu^{p|UR}\}$, $\{w_o\}$, $\{L_o\}$, $\{\overline{L}_o\}$, and parameter values θ, α, ν, and κ, we can solve for a vector of $\{\hat{w}_o\}$ satisfying the equilibrium in relative changes defined in (32)-(37) with $\hat{\tau}_{FU} < 1$ and $\hat{\tau}_{UF} < 1$. Therefore, we can proceed to solve other endogenous variables in the "new" equilibrium.

Calibration

We calibrate the initial equilibrium of the stylized world to the year of 2000. We obtain trade shares $\{\pi_{do}\}$ among urban China, rural China and rest of the world from the World Input-Output Table. To allocate trade flow between urban China and rural China, we assume that the service sector is non-tradable, and assign all agricultural outputs in China to rural China R and all manufacturing outputs in China to urban China U.

Table 8: Data and Paramatrisation Strategy

Data & Parameters	Value	Description	Source
π_{do}	data	Trade shares	World Input-Output Table 2000
μ_{do}	data	Migration shares	China's population census 2000
α	data	Average remittance-income ratio	CHIPS data 2002
θ	4	Trade elasticity	Simonovska & Waugh (2014)
ν	2.02	Distribution parameter	Caliendo et al. (2019)
κ	0.7	Shock correlation parameter	

Turning to the endogenous variables related to migration, we obtain $\{\mu_{UR}, \mu_{RR}\}$ from China's population census in 2000. $\mu^{p|UR} = 0.369$ is obtained from CHIPS data, and $\mu^{c|UR} = 1 - \mu^{p|UR}$. $\{\overline{L}_o\}$ are obtained from the 2000 population census and the world population. We can thus compute $\{L_o\}$ consistent with the information above using equation (25). Finally, by combining equations (26) and (27), we can solve for the unique $\{w_o\}$ that pins down the initial equilibrium.

We calibrate trade elasticity $\theta = 4$. $\alpha = 0.8$ is chosen to match the average remittance-income ratio in the CHIPS data. $\nu = 2.02$ comes from Caliendo et al. (2019).[6] To our knowledge, there is no prior estimate of the shock correlation parameter κ concerning the complete-partial migration context. Therefore, we set $\kappa = 0.7$ so that the correlation between preference shocks within the same location between migration modes is $1 - \kappa^2 \approx 0.5$.

[6] Caliendo et al. (2019) obtain an estimate of $\nu = 5.34$ at a quarter frequency, which corresponds to $\nu = 2.02$ at an annual frequency.

Results

The effect of changes in trade costs on migration, remittances and welfare, starting from the initial equilibrium in 2005, are illustrated in the figures below.

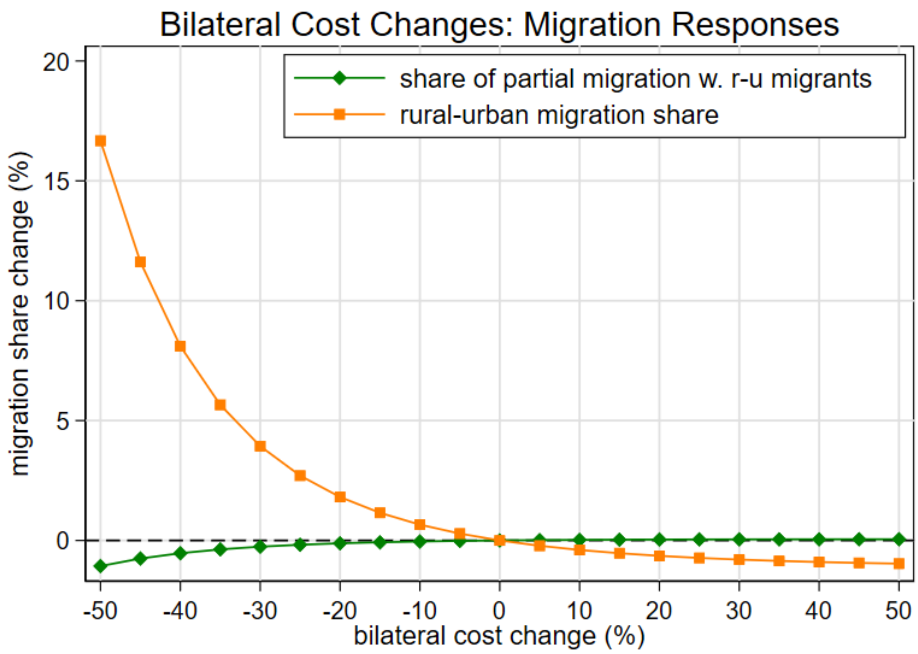

Figure 4: Effect of Bilateral Trade Cost Changes on Migration

Figure 4 displays the model implied changes in migration shares due to a bilateral trade shock. The figure highlights that a reduction of bilateral trade costs increases the overall share of rural to urban migrants. Here, a decrease in trade costs by 50% increases the migration share by about 16%. Intuitively, lower trade costs increase export related production in Urban, which increases the demand for labour and wages subsequently. Note that for larger bilateral trade cost changes, the share of complete migrants tends to increase over-proportionately among the different modes of migration. This is because the price index in Urban reduces by relatively more compared to Rural, implying that migrants will tend to chose complete migration in order to fully benefit from the lower price level in the urban region.

Figure 5 below illustrates the effect of bilateral trade cost changes on wages and remittances. For small reductions in trade costs the urban and rural wages tend to increase, with the urban wage increasing relatively more. However, for larger changes in trade costs the rural wages tend to decrease, implying a widening between the urban-rural wage gap. The increase in the extensive margin of migration in turn, means that remittances overall increase. With a reduction in trade costs by 50%, remittance increase by more than 30%, indicating a significant increase in cross-regional transfers. Overall, this figure highlights that reductions in bilateral trade costs have two competing effects on regional inequality. First, there tends to be an increase in regional inequality as the urban-rural wage gap increases. On the other hand, the migration-induced increase in remittance counteracts the first effect. It is clear to see that it is important to consider the role of remittances in distributing the gains from trade across regions, when studying the distributional effects of trade.

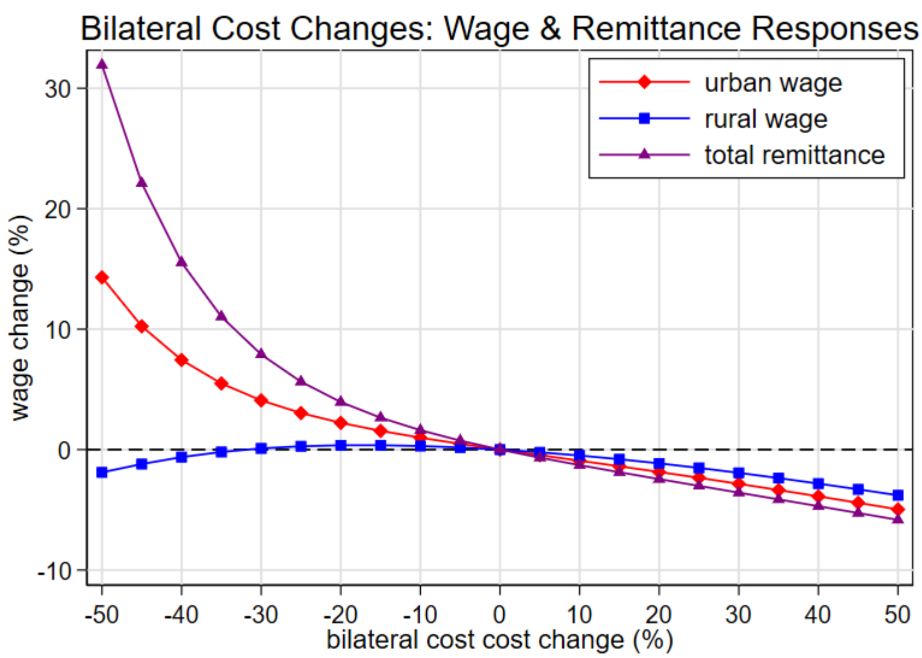

Figure 5: Effect of Bilateral Trade Cost Changes on Wages and Remittances

Figure 6 confirms the predictions regarding trade liberalisation and regional inequality, i.e. lower trade costs increase the urban-rural real wage gap. Complete migrants in Urban benefit slightly more than partial migrants as they can take full advantage of the price decline in Urban while partial migrant households need to consume from both regions. With lower international trade costs, production of export goods increase in Urban, increasing labour demand and wages in this region. Moreover, since we assume no internal trade costs between the different regions of China, the price decline in imported goods get distributed via domestic trade from Urban to Rural. This in turn, magnifies the first effect, i.e. more production is allocated to the Urban region and production in the rural reduces, which tends to further decrease the real wage in Rural.

Taken together, this quantitative exercise suggests that the mode of migration, as well as the associated remittances, are quantitatively important channels for the distributional implications of international trade. In particular, the remittances effect, to the best of our knowledge, is novel to the literature. Operating through changes in migration shares, this channel has important implications for measuring between region inequality and overall welfare.

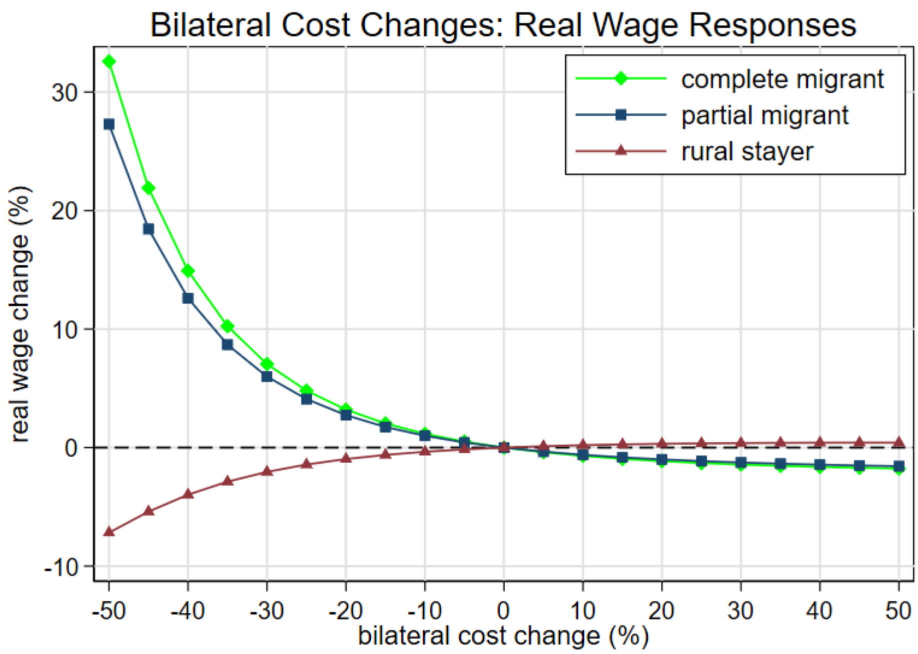

Figure 6: Trade Cost Changes: Real Wage

6 Conclusion

In this paper, we study the role of households' 'partial migration' decisions and the associated remittances in distributing the benefits of growing trade across space. We use Chinese household and trade data to establish novel empirical facts that connect trade, migration, and remittances. Our empirical evidence suggests that a considerable share of rural-to-urban migrants, triggered by growing manufacturing exports, are partial migrants, who tend to send a large share of their incomes as remittances to support their families in the rural homes.

We quantify the role of partial migration and remittances by explicitly incorporating these channels in a spatial general equilibrium model of trade and migration. In doing so, our paper is the first to document and account for the empirical facts regarding trade, migration and remittances qualitatively as well as quantitatively. In particular, we allow a rural resident to choose between two types of migration when he/she decides to migrate.

Moreover, in order to illustrate the relevance of the mechanism we propose, we calibrate a simplified version of our model to match a bilateral trade cost reduction between China and the rest of the world. Our quantitative exercise suggests that the mode of migration, as well as the associated remittances, are quantitatively important channels for the distributional implications of international trade. In particular, the remittances effect, to the best of our knowledge, is novel to the literature. In so doing, we deliver novel insights about the distributional implications of international trade in the presence of mobility frictions and heterogeneous forms of domestic migration.

References

Adamopoulos, T., Brandt, L., Leight, J., Restuccia, D., 2017. Misallocation, selection and productivity: A quantitative analysis with panel data from China. Technical Report. National Bureau of Economic Research.

Allen, T., Arkolakis, C., 2014. Trade and the topography of the spatial economy. The Quarterly Journal of Economics 129, 1085–1140.

Brandt, L., Hsieh, C.T., Zhu, X., 2008. Growth and structural transformation in china. China's great economic transformation , 683–728.

Caliendo, L., Dvorkin, M., Parro, F., 2019. Trade and labor market dynamics: General equilibrium analysis of the china trade shock. Econometrica 87, 741–835.

Cao, K.H., Birchenall, J.A., 2013. Agricultural productivity, structural change, and economic growth in post-reform china. Journal of Development Economics 104, 165–180.

Coşar, A.K., Fajgelbaum, P.D., 2016. Internal geography, international trade, and regional specialization. American Economic Journal: Microeconomics 8, 24–56.

Dix-Carneiro, R., Kovak, B.K., 2017. Trade liberalization and regional dynamics. American Economic Review 107, 2908–46.

Dustmann, C., Mestres, J., 2010. Remittances and temporary migration. Journal of Development Economics 92, 62–70.

Eaton, J., Kortum, S., 2002. Technology, geography, and trade. Econometrica 70, 1741–1779.

Facchini, G., Liu, M.Y., Mayda, A.M., Zhou, M., 2019. China's "great migration": The impact of the reduction in trade policy uncertainty. Journal of International Economics 120, 126–144.

Fan, C.C., 2008. Migration, hukou, and the city. China urbanizes: Consequences, strategies, and policies , 65–89.

Fan, J., 2019. Internal geography, labor mobility, and the distributional impacts of trade. American Economic Journal: Macroeconomics 11, 252–88.

Jung, J.W., Simonovska, I., Weinberger, A., 2019. Exporter heterogeneity and price discrimination: A quantitative view. Journal of International Economics 116, 103–124.

Lucas, R.E., Stark, O., 1985. Motivations to remit: Evidence from botswana. Journal of political Economy 93, 901–918.

Ngai, L.R., Pissarides, C.A., Wang, J., 2019. China's mobility barriers and employment allocations. Journal of the European Economic Association 17, 1617–1653.

Rapoport, H., Docquier, F., 2006. The economics of migrants' remittances. Handbook of the economics of giving, altruism and reciprocity 2, 1135–1198.

Redding, S.J., 2016. Goods trade, factor mobility and welfare. Journal of International Economics 101, 148–167.

Rozelle, S., Taylor, J.E., DeBrauw, A., 1999. Migration, remittances, and agricultural productivity in china. American Economic Review 89, 287–291.

Tombe, T., Zhu, X., 2019. Trade, migration, and productivity: A quantitative analysis of china. American Economic Review 109, 1843–72.

Wang, F.L., 2005. Organizing through division and exclusion. Stanford University Press.

Zi, Y., 2020. Trade liberalization and the great labor reallocation .

A Appendix: Empirical Analysis

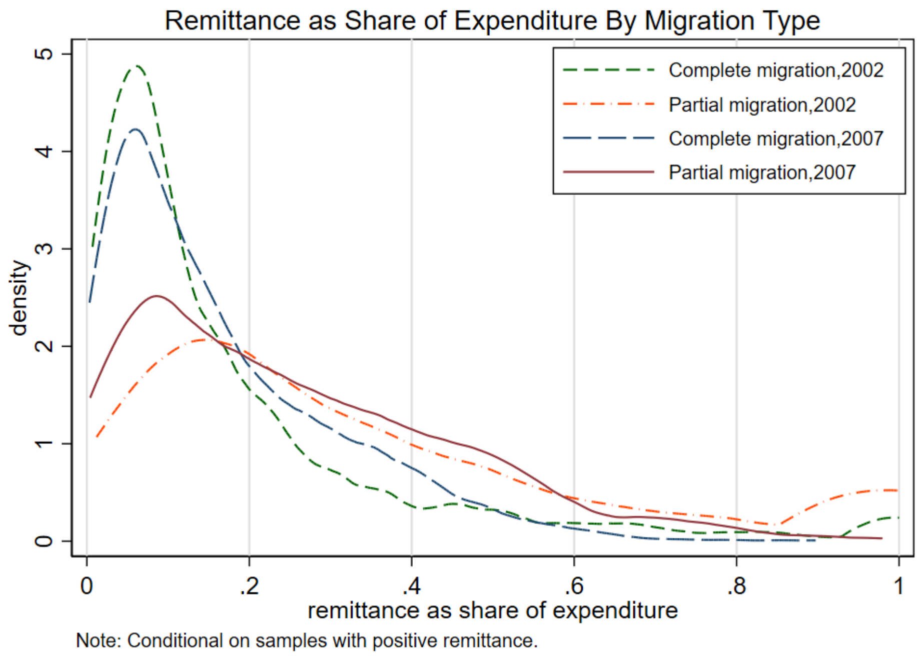

Figure 7: Distribution of Remittance Intensity by Migration Type

Table 9: Remittance as % of income by migration type, cond. on + remittance

Year	(1) 2002	(2) 2007	(3) All
Complete migration	0.106	0.152	0.140
	(0.118)	(0.159)	(0.150)
Partial migration	0.204	0.249	0.233
	(0.174)	(0.229)	(0.213)
Total	0.157	0.193	0.182
	(0.157)	(0.197)	(0.187)
Observations	957	2,265	3,222

Note: Standard deviations in parentheses.

Table 10: Remittance as % of expenditure by migration type, cond. on + remittance

Year	(1) 2002	(2) 2007	(3) All
Complete migration	0.179	0.165	0.169
	(0.209)	(0.142)	(0.162)
Partial migration	0.345	0.253	0.284
	(0.296)	(0.195)	(0.238)
Total	0.266	0.202	0.221
	(0.271)	(0.172)	(0.208)
Observations	957	2,265	3,222

Note: Standard deviations in parentheses.

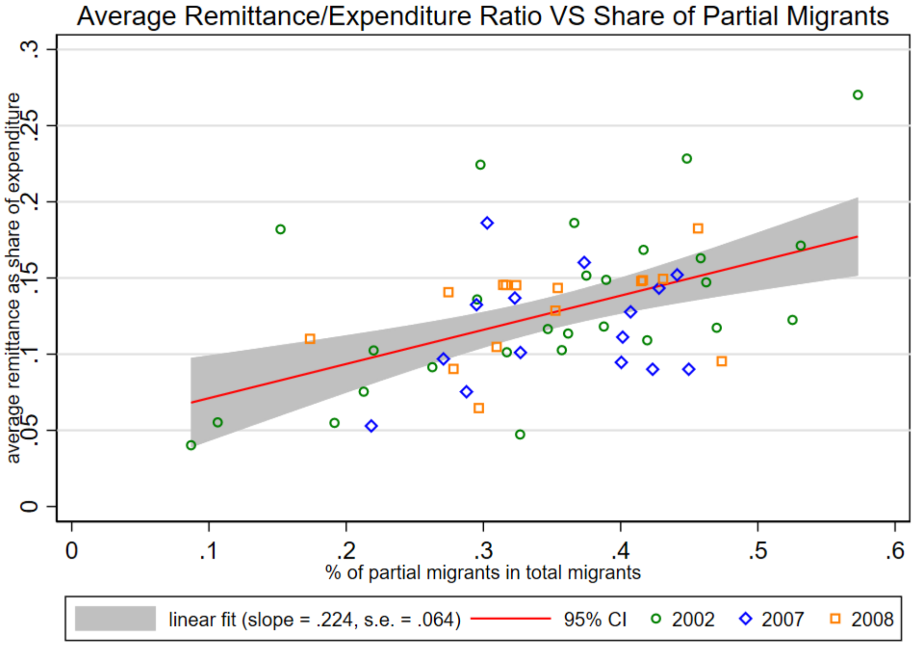

Figure 8: Remittance and Partial Migration: Across Cities

Table 11 below is similar to Table 4. Here we add addition controls for local hukou, marriage status, gender, age bin, household size, and education of the household head.

Table 11: Partial migrants remit more than complete migrants

	(1)	(2)	(3)	(4)	(5)
Dependent var:	$\mathbf{1}(R > 0)$	R/I	R/I	R/E	R/E
Partial migration	0.155***	0.062***	0.052***	0.081***	0.067***
	(0.016)	(0.005)	(0.007)	(0.006)	(0.008)
Mean of y	0.596	0.109	0.183	0.129	0.217
City-sector-year FE	Yes	Yes	Yes	Yes	Yes
Drop 0 remittance	No	No	Yes	No	Yes
Within R-squared	0.040	0.114	0.159	0.126	0.177
Observations	8,084	8,083	4,821	8,084	4,821

Note: Robust standard errors in parentheses. *, ** and *** indicate significance at 10%, 5% and 1% levels.