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po icies t at ade igratio easier. t is paper, we qua tify t e i pact of igratio po icy c a ges o C i a's growt , structura c a ge, a d regio a i co e co verge ce.

o acco p is t is, we co pi e u ique y detai ed data o productio , capita , e p oy e t, trade, a d igratio i C i a. ese data revea four ey facts co cer i g C i a's structura c a ge a d regio a co verge ce. First, t ere was sig i ca t regio a co verge ce i rea GDP per wor er betwee 2000 a d 20 5. e varia ce of t e cross-provi ce (og) GDP per wor er dec i ed by a t ird, fro 0.2 i 2000 to 0. 5 i 20 5. Seco d, over t e sa e period, t ere were itt e co verge ce i GDP per wor er wit i t e agricu tura a d o -agricu tura sectors. ird, structura c a ge was a i porta t co tribu-tor to growt a d co verge ce. e fractio of e p oy e t i agricu ture fe fro 53% i 2000 to 28% i 20 5. e argest c a ges occurred i provi ces wit ower i itia eve s of i co e, ig er i itia s ares of agricu tura e p oy e t, a d arger gaps i abor productivity betwee t e agricu tura a d o -agricu tura sectors. erefore rea ocatio of abor fro agricu ture to t e o -agricu tura sector resu ted i arger i creases i aggregate GDP per wor er i poor provi ces t a i ric er provi ces a d co tributed sig i ca t y to t e co verge ce i aggregate i co e across provi ces. Fourt , t e struc-tura c a ge is c ose y re ated to i ter-provi cia igratio . Provi ces wit ig er s ares of e p oy e t i agricu ture i 2000 ad arger i ter-provi cia rura -urba igratio ows. ese facts suggest t at igratio -i duced structura c a ge is esse tia for C i a's growt a d regio a i co e co verge ce betwee 2000 a d 20 5.

We bri g our data to a ric yet tractab e spatia equi ibriu ode of C i a's eco o y to bot easure c a ges i igratio costs a d ot er frictio s i C i a's eco o y a d to qua tify t eir i pacts o igratio , structura c a ge, growt , a d regio a i co e co verge ce. We d t at betwee 2000 a d 20 5 igratio costs fe by forty- ve perce t, wit t e cost of ovi g fro agricu tura rura areas to o -agricu tura urba o es fa i g eve ore. additio to co tributi g to growt , t ese igratio cost c a ges accou t for t e ajority of t e rea ocatio of wor ers out of agricu ture a d t e drop i regio a i co e i equa ity. We co pare t e effect of igratio po icy c a ges wit ot er i porta t eco o ic factors, i c udi g c a ges i trade costs, capita ar et distortio s, average cost of capita , a d productivity. W i e eac co tributes ea i gfu y to growt , igratio po icy c a ges are ce tra to C i a's structura c a ge a d regio a co verge ce. Fi a y, we d t at t e s ow-dow i growt betwee 20 0 a d 20 5 is associated wit a s a er reductio i i ter-provi cia igratio costs a d a arger ro e of capita accu u atio duri g t is ve-year period.

Our ode bui ds o rece t deve op e ts i i ter atio a trade. particu ar, we e te d t e Eato a d Kor-tu , (2002) ode to u ti-sector as i Ca ie do a d Parro (20 5) a d i corporate bot i perfect spatia a d sector abor obi ity as i o be a d Z u (20 9). additio , we a ow for capita as a i put i productio a d frictio s i capita a ocatio across space a d sectors. o better ide tify i ter-sector igratio costs, we a so co sider ouse o d prefere ces t at are o - o ot etic to co tro for t e i pact of i co e growt o rura -urba igratio .

Our wor co tributes to t e iterature i vestigati g t e effect of C i a's syste , a d rece t refor s to it. ost rece t y, Zi (20 9) e p ores t e effect of i ter a frictio s i C i a's abor ar et o ow trade ibera izatio i proves we fare. particu ar, restrictio s te d

Fi a y, our paper is c ose y re ated to a d bui d o t e wor by ` o be a d Z u (20 9). We e te d t eir wor t eoreti-ca y by i corporati g i to t e ode p ysica capita as a i put i productio a d i co e effect t roug o - o ot etic prefere ces. We a so e te d t eir wor e pirica y by e te di g t eir a a ysis of t e i pact of trade a d igratio o C i a's growt betwee 2000 a d 2005 to a uc o ger a d ore rece t period, fro 2000 to 20 5. ost i porta t, we go beyo d t eir a a ysis o aggregated GDP growt by studyi g t e i pact of igratio cost c a ges a d ot er c a ges o bot structura c a ge a d regio a i co e i equa ity i C i a.

We begi our a a ysis wit a detai ed review of t e data i Sectio 2, w ere we docu e t ey patter s i C i a's regio a eco o ic growt , structura c a ge, a d igratio betwee 2000 a d 20 5. Wit t e data i a d, we deve op a ric ode of C i a's eco o y t at ca be broug t to t e data i Sectio 3. We t e use t is ode to qua tify t e ag itude a d co seque ce of c a ges i igratio costs, trade costs, capita ar et distortio s, a d productivity. We docu e t t e resu ts of t is qua titative a a ysis i Sectio 4 before co c udi g i Sectio 5.

2. Migration, structural change, and regional income convergence

t is sectio , we docu e t arge i co e disparity across provi ces a d betwee t e agricu tura a d o -agricu tura sectors i C i a i 2000, a d t e sig i ca t regio a i co e co verge ce a d structura c a ge betwee 2000 a d 20 5. We a so provide evide ce suggesti g t at t e structura c a ge a d regio a i co e co verge ce are i ti ate y re ated. We t e discuss t e igratio po icy c a ges a d t e resu ti g i creases i i ter a igratio as a i porta t driver for bot t e structura c a ge a d regio a i co e co verge ce. First, owever, we discuss brie y t e data we use for t e paper.

2.1. D

For our a a ysis, we co bi e t ree sources of data o i ter a igratio , i ter a a d i ter atio a trade, a d provi cia eco o ic accou ts i C i a. We brie y ist t e i porta t variab es ere, a d provide a ore t oroug descriptio i t e appe di .

Migration. Our igratio data are fro C i a's popu atio ce sus. additio to t e 2000 a d 2005 ce sus data used by ` o be a d Z u (20 9), we a so use t e co de tia icro data of t e 20 0 a d 20 5 popu atio ce sus of C i a. ` ese ce sus data provide detai ed i for atio about rura -urba a d cross-provi ce igratio fro 2000 to 20 5.

Trade. We co struct i ter-provi cia trade ows based o t e i ter-provi cia i put-output tab e for 2002, 2007, a d 20 2 fro Li (20 0), Liu et a . (20 2), a d Liu et a . (20 8), respective y.

Provincial GDP and Employment. We co struct provi cia GDP, capita stoc , a d e p oy e t for agricu ture a d o -agricu ture based ai y o t e data pub is ed i t e C i a Statistica Yearboo (CSY) by C i a's Natio a Bureau of Statis-tics (NBS). ` e co structio et ods for GDP a d e p oy e t are t e sa e as i ` o be a d Z u (20 9). owever, after 20 0, t e NBS o o ger pub is es provi cia eve e p oy e t by sector. For 20 5, we t erefore esti ate provi cia e p oy-e t based o t e data pub is ed i t e provi cia yearboo s. We describe t e fu esti atio procedure i t e appe di .

Provincial Capital Stock. ` e CSY reports o i a Gross Fi ed Capita For atio (GFCF) by provi ce but ot by sector. owever, it does report t e ed-asset i vest e t by provi ce a d sector. We appro i ate eac sector's s are of capita for atio by usi g t e sector's s are of tota ed-asset i vest e t. ` e rea i vest e t is o i a GFCF de ated usi g t e provi ce-speci c i vest e t price i de reported i t e CSY. We t e co struct capita stoc usi g a perpetua i ve tory et od assu i g a depreciatio rate of 7%. ` e average i vest e t growt rates of t e rst te years of a provi ce are used to ge erate i itia capita stoc va ues for 978. Our esti ates of a ua rea i vest e t, ess depreciatio , are t e used to ca cu ate capita stoc i subseque t years.

2.2. F

` o be a d Z u (20 9) docu e t arge differe ces i rea abor i co e across provi ces a d betwee t e agricu tura a d o -agricu tura sectors i C i a i 2000, a d t ey argue t at a i porta t reaso for t ese differe ces is t e syste t at i poses severe restrictio s o wor er obi ity wit i C i a. ere we s ow t e evo utio of t e distributio of rea retur s to abor across provi ces a d sectors over t e 5-year period after 2000.

Usi g data o rea GDP, e p oy e t, a d factor s ares, t e rea argi a retur to abor is

$$= \alpha \tilde{\beta} \cdot \frac{}{L}, \qquad ( )$$

w ere is rea GDP of sector i provi ce , L is e p oy e t, $\tilde{\beta}$ · is abor's s are of va ue-added, a d α is t e s are of o - ousi g goods a d services i GDP. We disp ay t e distributio of rea argi a retur s to abor for 2000, 2005, 20 0, a d 20 5 i Fig. a, w ic revea s persiste t wit i -sector dispersio of abor retur s across provi ces a d arge gaps

` ese data are fro NBS icro survey databases: 20 0 C i a Popu atio Ce sus irco-database a d 20 5 % Sa p e C i a Popu atio Ce sus irco-database.

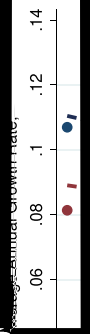
w ere $\tilde{\beta}$ de otes capita 's ( ) s are of va ue-added a d t e o i a GDP of sector i provi ce . Note t at we e a i e o i a rat er t a rea retur s to capita because capita ow ers ca i vest across ocatio s a d sectors wit - out avi g to co su e at t e i vest e t desti atio s. ` erefore t ey care about o i a retur differe ces o y a d t e differe ces i t e cost of ivi g across ocatio s a d sectors do ot direct y affect t eir i vest e t decisio s. f t ere are o capita ar et frictio s, t e i vestors' arbitrage wou d i p y t at t e o i a retur s ' equa ize across a sectors a d provi ces. So, t e dispersio i t e o i a retur s to capita re ects frictio s t at resu t i capita isa ocatio . s i ustrated i Fig. b, t e dispersio of capita retur s across provi ces was persiste t y arge i agricu ture, but sig i ca t y s a er i t e o -agricu tura sector. ` ere was a dec i e i t e dispersio of capita retur s i t e o -agricu tura sector betwee 2000 a d 2005, but t e dispersio t e i creased betwee 20 0 a d 20 5. ` e C i ese gover e t's assive i - frastructure a d sti u us spe di g after t e g oba a cia crisis ay ave co tributed to t e worse i g capita a ocatio s duri g t at period, as poi ted out by Bai et a . (20 6).

2.3. m

W i e t e wit i -sector dispersio i abor i co e did ot s ow a sig i ca t dec i e betwee 2000 a d 20 5, t ere was a dra atic reductio i t e i equa ity of t e aggregate provi cia abor i co e over t e sa e period. ` e cross-provi ce varia ce of og rea GDP per wor er was 0.2 i 2000. But by 20 5, t is varia ce dec i ed to 0. 5 – a o e-t ird reductio i regio a i co e i equa ity. Be i d t is sig i ca t dec i e was t e faster abor i co e growt e perie ced by i itia y ower- i co e regio s. pa e (a) of Fig. 2, we disp ay t e growt rates of rea GDP per wor er betwee 2000 a d 20 5 of a t e provi ces agai st t eir i itia rea GDP per wor er eve s i 2000. ` ere is a sig i ca t egative re atio s ip betwee t e i itia eve of i co e a d subseque t i co e growt , i p yi g stro g i co e co verge ce over t is 5-year period. egressi g t e average growt o i itia rea GDP per wor er revea s a precise y esti ated β–co verge ce coefficie t of appro i ate y 2%. ` at is, a 0% ig er i itia i co e eve is associated wit a 0.2% ower average a ua growt rate.

W at's be i d t is reductio i regio a i equa ity? pa e (b) of Fig. 2,

(b)


.14
.12
.1
.08
.06


.04
−1
−.5
0
Log GDP/Worker in 2000, Relative
log(GDP/worker)

Table 1
Wor er igratio i C i a, 2000–20 5.

	tra-Provi cia				ter-Provi cia			
	2000	2005	20 0	20 5	2000	2005	20 0	20 5
ota igra t Stoc	0 .5	32.6	76.2	2 5.7	29.7	7.0	79.2	90.2
Em m (%)								
ota igra ts	.	7.8	22.9	28.0	.	6.5	0.3	.7
g-to-No ag igra ts	3.0	6.5	2 .6	25.5	3.3	5.2	8.6	7.0
No igra t g Wor ers	63.0	55.5	6.3	3 .6	63.0	55.5	6.3	3 .6

Note: Disp ays t e u ber of wor ers ivi g a d wor i g outside t eir area of registratio . e rst row is i i io s. e ast t ree rows are s ares of tota e p oye e t.

wor er igratio fro agricu ture to o -agricu ture, bot wit i - a d betwee -provi ces, ca be a i porta t driver of t e structura c a ge i C i a.

2.4. I m C

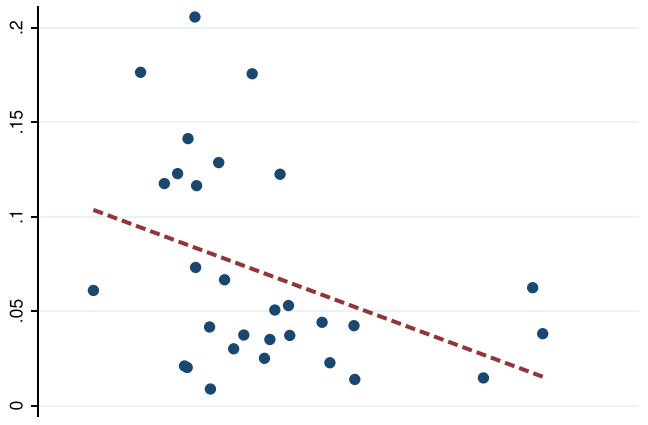
Before tur i g to t e data o igratio a d structura c a ge, we rst provide a su ary of C i a's i ter a igratio po icy a d rece t c a ges to it. e C i ese gover e t fo a y i stituted a ouse o d registratio or syste i 958 to co tro abor obi ity. C a (20 9) provides a detai ed a d up-to-date discussio of t e syste a d its refo s. Brie y, eac C i ese citize is assig ed a , c assi ed as "agricu tura (rura)" or " o -agricu tura (urba)" i a speci c ocatio . dividua s eed approva s fro oca gover e ts to c a ge t e category (agricu tura or o -agricu tura) or ocatio of , a d it is e tre e y difficu t to obtai suc approva s. additio , prior to 2003, wor ers wit out oca ad to app y for a te porary reside ce pe it. s t e de a d for igra t wor ers i a ufacturi g, co structio , a d abor i te sive service i dustries i creased, a y provi ces, especia y t e coasta provi ces, e i i ated t e require e t of te porary reside ce pe it for igra t wor ers after 2003. ere was a so a atio -wide ad i istrative refo i 2003 t at great y strea i ed t e process for getti g a te porary reside ce pe it i ot er provi ces. ese po icy c a ges ade it uc easier for a wor er to eave t eir ocatio a d wor so ew ere e se as a igra t wor er. owever, eve wit a te porary reside ce pe it, igra t wor ers wit out oca ave i ited access to oca pub ic services a d face ig er costs for ea t care a d for t eir c i dre 's educatio . t e ate 990s, a few oca es bega e peri e ti g wit e i i ati g t e disti ctio betwee oca agricu tura / o -agricu tura popu atio s, providi g a oca reside ts wit a e tit i g t e equa access to oca pub ic services. is was eve tua y fo a ized a d e te ded to t e w o e atio i 20 . t t e sa e ti e, owever, t e gover e t as tig te ed t e require e t for gra ti g to igra ts i t e rst- a d seco d- tiered cities. So, over ti e, it as beco e easier for a rura igra t wor er to obtai i a oca urba area i ower tiered cities, but it as beco e arder i rece t years for t e to ove to arge coasta cities due to t e stricter restrictio s t ere.

Based o popu atio ce sus data, we report i ab e bot i ter-provi cia a d i tra-provi cia igratio i C i a for t e years of 2000, 2005, 20 0, a d 20 5.[2] s a refere ce, we a so report t e s are of wor ers w o are o -igra t agricu - tura wor ers. wor er is de ed as a i ter-provi cia igra t if t ey wor ed outside t eir provi ce of registratio . d t ey are de ed as a i tra-provi cia igra t if t ey wor ed wit i t eir provi ce of registratio but outside t eir sector of registratio . Our de itio of i tra-provi cia igratio is broader t a usua . So e wor ers wit agricu - tura ay wor i o -agricu ura jobs oca y (wit i t e vi age or tow s ip of t eir registratio) a d t ey are c assi ed as i tra-provi cia igra t wor ers. We c oose t is de itio because we d fro t e 2005 i i-ce sus data t at t e average i co e of t ese oca "igra t wor ers" is ore t a 2.5 ti es as ig as t at of t e oca far ers. is suggests t at t ere are sig i ca t frictio s for rura wor ers switc i g sectors oca y. our robust ess a a ysis ater, we wi co sider a stricter de itio of igra t wor ers.

s docu e ted by ab e a d Z u (20 9), t e re a atio of restrictio s o igratio betwee 2000 a d 2005 resu ted i sig i ca t i creases i bot i tra- a d i ter-provi cia igratio .[3] e ge era tre d see s to ave co ti ued betwee 2005 a d 20 5, wit t e i tra- a d i ter-provi cia igra t wor ers' s ares of tota e p oye e t i creased fro 7.8% a d 6.5%, respective y, i 2005, to 28% a d .7% i 20 5. Betwee 20 0 a d 20 5, owever, t e i crease i i ter- provi cia igratio s owed sig i ca t y, a d t e cross-provi cia rura -urba igra t wor ers' s are of tota e p oye e t i 20 5 is actua y ower t a t at i 20 0. co trast, wit i -provi ce rura -urba igratio co ti ued to i crease sig if- ica t y t roug 20 5. ese patter s are co siste t wit t e po icy c a ges adopted by t e C i ese gover e t after 20 0 t at ave ade ovi g to top tier cities, t e desti atio s of uc of t e i ter-provi cia igratio , uc arder for peop e wit rura a d, at t e sa e ti e, e couraged oca urba izatio i poor i a d a d wester provi ces.

[2] e igratio stoc s are ca cu ated fro t e data o igra t s ares fro t e ce sus data a d t e tota e p oye e t data i t e C i a Statistics Yearboo s. See appe di for detai s.

[3] Our esti ated igratio stoc s are s ig t y differe t fro t ose reported by ab e a d Z u (20 9) because we ow use ore detai ed sa p e weig ts provided by t e NBS.


.2
.15
.1
.05
0

eve s of i co e wit i eac regio i a tractab e a er.[4] d a t oug a c osed fo represe tatio of t e direct uti - ity fu ctio does ot e ist, it i c udes t e sta dard Cobb-Doug as prefere ces as a specia case w e $B = 0$ a d $\epsilon = .$ he imp ied aggregate s ares of spe di g a ocated to goods a d ousi g are provided i t e fo owi g propositio .

Proposition 1. , -

$$\Psi^{\cdot} = \alpha\phi + B\left(\frac{}{}\right)^{\gamma}\left[\frac{-}{\left(^{\phi}\ {}^{-\phi}\right)^{\alpha}\ ,\ {}^{-\alpha}}\right]^{-\epsilon}, \tag{6}$$

$$\Psi^{\cdot} = \alpha(- \phi) - B\left(\frac{}{}\right)^{\gamma}\left[\frac{-}{\left(^{\phi}\ {}^{-\phi}\right)^{\alpha}\ ,\ {}^{-\alpha}}\right]^{-\epsilon}, \tag{7}$$

$$\Psi^{\cdot} = \ - \alpha \tag{8}$$

$$^{-} = \left[\sum \ ( )^{-\epsilon}\omega\ ( )\right]^{-\ /\epsilon} \qquad m \qquad m \qquad , \qquad \omega\ ( ) \propto \ ( )L\ ( )$$
$$- \qquad m \quad (,).$$

Proof. See t e appe di . □

he ese spe di g s ares imp y t at as i co e grows arge, t e s are a ocated to t e purc ase of t e agricu tura good co verges to $\alpha\phi$ fro above. Si i ar y, t e s are a ocated to t e o -agricu tura good co verges to $\alpha(- \phi)$ fro be ow. d t e s are a ocated to ousi g is ed. t e of t e paper, we wi co sider t e case w e $B =$ certai situatio s, it is co ve ie t to represe t uti ity as a fu ctio of rea i co es a d e pe diture s ares. Usi g Eq. (6) to substitute for re ative prices i Eq. (5), o e ca write t e uti ity of a i dividua wit rea i co e ν ( ) a ocati g a s are $\psi^{\cdot}$ ( ) of t eir i co e to agricu ture goods as

$$( ) = \left(\frac{}{\epsilon} - \frac{\psi^{\cdot}\ ( ) - \alpha\phi}{\gamma}\right)\ \ ( )^{\epsilon}. \tag{9}$$

he e pressio wi prove particu ar y usefu i t e ca ibratio a d qua titative a a ysis to co e, as it aps direct y to data o e pe diture s ares a d rea i co es.

3.2.

Wit i eac sector, a goods are produced as aggregates over a co ti uu of i dividua varieties $\nu \in [0, \ ]$ accordi g to t e CES tec o ogy

$$= \left(\int_0 \ (\nu)^{(\sigma -)/\sigma}\ \nu\right)^{\sigma/(\sigma -)}, \tag{ 0}$$

w ere σ is t e e asticity of substitutio across varieties. For eac variety, producers use abor, capita , a d, a d a co posite i ter ediate good to produce output usi g t e Cobb-Doug as tec o ogy,

$$(\nu) = \ (\nu)\ \ (\nu)^{\beta^{\cdot}}\ \ (\nu)^{\beta^{\cdot}}\ \ (\nu)^{\beta^{\cdot}} \prod_{=\{\ ,\ \}} m\ (\nu)^{\beta^{\cdot}}, \tag{ }$$

w ere $\beta^{\cdot} + \beta^{\cdot} + \beta^{\cdot} + \sum \beta^{\cdot} = .$ he imp ies t at t e arg i a cost of productio is i verse y proportio a to productivity a d proportio a to t e cost of a i put bu d e

$$\propto (\ )^{\beta^{\cdot}}(\ ^{\cdot})^{\beta^{\cdot}}(\ ^{\cdot})^{\beta^{\cdot}} \prod_{=\{\ ,\ \}} (\ )^{\beta^{\cdot}}. \tag{ 2}$$

W i e a sector's co posite output is ot tradeab e, i dividua varieties are. rade is cost y, owever, a d τ u its ust be s ipped for o e to arrive at t e desti atio . rade wit i a regio is cost ess, a d t erefore $\tau = .$ oget er wit t e arg i a costs of productio , t e price for sector varieties produced i regio a d s ipped to regio is

$$(\nu) = \tau \ \ / \ (\nu). \tag{ 3}$$

[4] a ter ative c oice is t e o o ot etic CES prefere ces (Co i et a ., 20 5). owever, i t is case, we ca ot aggregate co su ptio de a d of t e igra ts a d o -igra ts i to t e de a d of a represe tative age t. t is pri ari y for t is reaso t at we opt for t e P GL speci catio .

I e overa patter of co sumer a d busi ess i ter ediate spe di g across possib e supp iers fro eit er t eir ow regio or fro ot ers is suc t at t e cost of a sector's aggregate co posite good is i i ized. s de o strated by Eato a d Kortu (2002), if productivity is distributed Fréc et, wit CDF give by $F(\ ) = \ ^{-\theta}$, wit varia ce para eter θ a d ocatio para eter , t e t e s are of tota sector spe di g a ocated by buyers i regio to producers i regio is

$$\pi \ \propto \ \left(\frac{\tau}{\quad}\right)^{-\theta}, \tag{4}$$

w ere t e price i de is

$$\propto \left[\sum_{=}^{N+} \ (\tau \ )^{-\theta}\right]^{- /\theta} . \tag{5}$$

bot Eqs. (4) a d (5), t e co sta t of proportio a ity is co o across regio s a d sectors.

I rade s ares fro Eq. (4) deter i e tota sa es of eac sector i a regio s. Give tota spe di g by co sumers a d ms i regio o goods fro sector , tota reve ue is

$$= \sum_{=}^{N+} \pi \quad , \tag{6}$$

w ic i p ies i ter ediate de a d by ms is β . Co bi ed wit a de a d spe di g by co sumers Ψ ¯ L , tota spe di g o good by co sumers a d ms i regio is t erefore

$$= \sum_{\in\{ \ , \ \}} \Psi \ ¯ L + \sum_{\in\{ \ , \ \}} \beta \ . \tag{7}$$

3.3. I m m m m , ,

Wor ers ear i co e fro wor a d, for o -migra t wor ers, fro t eir c ai s to a d a d capita retur s. Broad y co siste t wit C i a's i stitutio a setti g, we presu e o y oca o -migra t i dividua s receive i co e fro a d a d capita i t eir provi ce a d sector. I us, t e i co e of migra t wor ers is o y t eir wage w i e t e i co e of o - migra t oca s is δ , w ere $\delta >$ repre se ts t e ratio of tota i co e i c udi g rebate of a d a d capita i co e to abor i co e. We s ow ow to deter i e t e equi ibriu va ue of δ be ow.

I ota rebates i eac provi ce a d sector co bi e a u ber of sources. I ota spe di g o a d, for ousi g by i dividua s a d as a i put to productio by ms, equa s tota a d rebates. Speci ca y, if sectora sa es are t e spe di g o a d i puts is β a d if co sumer i co e is ¯ L t e t eir spe di g o ousi g is $(-\alpha)$ ¯ L . toget er, if tota a d supp y i a give provi ce a d sector is $\tilde{H}$ t e tota a d i co e is

$$\tilde{H} = \beta + (-\alpha) ¯ L . \tag{8}$$

Si i ar y, spe di g o capita by producers is proportio a to t eir tota sa es $\beta = K$.

3.4. C m

Capita ar et c eari g is atio a i scope. Î at is, tota capita de a ded by producers i a sectors a d provi ces ust add to t e tota capita supp y $\bar{K}$. s eac sector i eac provi ce opti a y c ooses a qua tity of capita de a ded to equate t e argi a reve ue product of capita to t e cost of capita t ey face, w ic re ects t e average cost of capita co o to a sectors a d t e capita wedge faci g t at particu ar sector a d provi ce. Speci ca y, give capita wedges suc t at $\beta \cdot /K = \equiv \bar{}/(-)$, we ave

$$\sum_{=}^{N} \sum_{\in\{ , \}} \frac{-}{\bar{}} \frac{\beta \cdot}{\beta \cdot} \quad L = \bar{K}, \tag{22}$$

si ce $\beta \cdot = L$ o d for a a d . Î is e pressio i ustrates t at, a e se equa , a reductio i t e average cost of capita re ects a risi g aggregate supp y $\bar{K}$. Î is wi prove to be a i porta t co po e t of rece t growt i C i a.

Îo co p ete t e ode , we e t so ve for t e equi ibriu igratio s ares m a d e p oy e t L i eac provi ce a d sector.

3.5. m

Wor ers i C i a c oose w ere to ive (a d wor) to a i ize we fare. Wor ers are eteroge ous i t eir taste for differe t provi ces a d sectors, a d face costs w e ivi g outside t eir provi ce of registratio . Labor is perfect y obi e across sectors i t e rest of t e wor d. W e decidi g i w ic provi ce a d sector to wor , a i dividua fro provi ce a d sector co pares t e pote tia uti ity eve i a desti atio s , t e igratio costs betwee (,) a d (,), a d t e pote tia oss of a d a d capita i co e re ected i δ . Fro Eq. (9), is as fo ows

$$= \begin{cases} \left(\frac{\delta^{\epsilon}}{\epsilon} - \frac{\psi \cdot -\alpha\phi}{\gamma} \right) v^{\epsilon} & = , = \\ \left(\frac{}{\epsilon} - \frac{\psi \cdot -\alpha\phi}{\gamma} \right) v^{\epsilon} & \neq , \neq \end{cases} \tag{23}$$

w ere $\psi \cdot$ a d v are t e spe di g s are o agricu ture goods a d rea i co e per wor er for igrati g wor ers ivi g i provi ce a d sector . additio , et wor er prefere ces over ocatio s be captured by , w ic is distributed ide tica y a d i depe de t y across wor ers a d fo ows a Fréc et distributio wit varia ce para eter κ. Wor ers t e c oose t e desti atio (,) to a i ize $/\mu$. So vi g for t e s are of wor ers t at opt to ove to eac possib e desti atio is straig tforward. We provide t e equi ibriu igratio s ares i t e fo ow propositio :

Proposition 3. *G , m μ , F F ( ),*

$$m = \frac{\left(/\mu \right)^{\kappa}}{\sum_{\prime\in\{ , \}} \sum_{\prime=}^{N} \left(/\mu \right)^{\kappa}} \tag{24}$$

m m E . (23).

Proof. See t e appe di . □

Î is e pressio for igratio s ares co ve ie t y su arizes t e patter of i ter-provi cia a d i ter-sectora oves by wor ers. Note t at t e para eter κ easures t e e asticity of igratio wit respect to uti ity. Fro Eq. (9), we ca see t at t e e asticity of igratio wit respect to rea i co e is $\epsilon\kappa$, w ic ca be direct y esti ated fro t e data. So, for a y give va ue of ϵ, we ca use t e esti ated i co e e asticity of igratio to i fer t e uti ity e asticity κ.

Fi a y, give t e igratio s ares a d registratio s, tota e p oy e t i eac provi ce a d sector is

$$L = \sum_{=}^{N} \sum_{\in\{ , \}} m \bar{L} , \tag{25}$$

a d t e u ber of o -igra t oca s is $L = m \bar{L}$.

4. Quantitative analysis

We ow bri g t e fu ode to data. We rst ca ibrate t e va ues of t e ti e-i varia t ode para eters. Give t ese para eter va ues a d for eac of t e four years (2000, 2005, 20 0, a d 20 5), we ca ibrate t e igratio costs, trade costs, capita wedges, t e average cost of capita , a d t e provi ce-sector speci c Î FPs so t at t e

Table 2
ode para eters a d i itia equi ibriu va ues.

Para eter	Va ue	Descriptio
$(\beta \cdot, \beta \cdot)$	(0.27,0. 9)	Labor's s are of output
$(\beta \cdot, \beta \cdot)$	(0.06,0. 5)	Capita 's s are of output
$(\beta \cdot, \beta \cdot)$	(0.26,0.0)	La d's s are of output
$(\beta \cdot, \beta \cdot)$	(0. 6,0.0)	gricu tura i put's s are of output
$(\beta \cdot, \beta \cdot)$	(0.25,0.6)	No agricu tura i put's s are of output
α	0.87	Goods' e pe diture s are
ϕ	0	gricu ture goods' s are i price i de
γ	0.30	Price-effect i e pe diture s ares
ϵ	0.70	co e-effect i e pe diture s ares
$\Psi \cdot$	*D*	gricu ture goods' e pe diture s are
θ	.0	E asticity of trade
κ	2.	eteroge eity i ocatio prefere ces
π	*D*	rade s ares
m	*D*	igratio s ares
$\bar{L}$	*D*	itia registratio s

Notes: Disp ays t e ai ode para eters a d t e i itia equi ibriu va ues for e doge ous objects set to atc data prior to so vi g t e ode i re ative c a ges. See te t for detai s.

4.1. C m -I m

o ease t e ca ibratio a d qua titative e ercise, we so ve t e ode i re ative c a ges as i De e et a . (2007). is requires a u ber of equi ibriu objects be set equa to data i t e i itia period equi ibriu , w ic i our case is t e year 2000. e ey objects ere are t e i itia trade s ares π , igratio s ares m , a d u bers of registered wor ers $\bar{L}$. particu ar, we use t e igratio s are atri fro t e 2000 ce sus a d t e e p oy e t by provi ce a d sector fro t e 2000 CSY to bac out t e i itia u bers of registered wor ers by provi ce a d sector,[5] a d eep t e co sta t for a t e qua titative a a ysis.[6]

We describe t e ca ibratio of eac ti e-i varia t ode para eter i detai be ow, a d report t e re eva t va ues i ab e 2. Productio fu ctio para eters are ca cu ated to atc t e s ares of sector output goi g to eac type of i put, as reported i our put-Output data. e s ares of co su er e pe ditures a ocated to ousi g is set to t e average s ares reported i t e CSY for rura (5%) a d urba (%) ouse o ds. gricu ture's s ares of e pe ditures i t e i itia equi ibriu $\Psi \cdot$ is a so fro t e data.

So e ode para eters correspo d to e pirica e asticities a d ot er o e ts i t e data. We set t eir va ues to correspo d to co o va ues fro t e iterature, a d e p ore t e se sitivity of our resu ts to a ter ative va ues i t e appe di . particu ar, t e e asticity of igratio ows to rea i co e differe ces $\epsilon\kappa$ is set to atc t e e asticity of .5 esti ated by obe a d Z u (20 9). Give our va ue for ϵ (described i a o e t), t is i p ies $\kappa = 2.$. e e asticity of trade ows wit respect to trade costs θ is set to , i i e wit evide ce fro i ter atio a trade. Fo owi g evide ce fro obe (20 5), we use t e sa e e asticity for bot t e agricu tura a d o -agricu tura sectors. ur i g to co su er prefere ce para eters, we set t e stre gt of t e i co e a d price effects i co su er e pe diture s ares to 0.7 a d 0.3, respective y. e for er is i i e wit der et a . (20 9) w o ds $\epsilon \in (0.68, 0.76)$ for t e U ited States across differe t ti e periods, but t e atter is ess precise. ey a so d va ues for ϵ i t e UK (0.76), Ca ada (0.3), a d ustra ia (.0). ere are ot er researc ers w o c oose ower va ues for ϵ. For e a p e, Boppart (20) sets it to 0.22 a d Ec ert a d Peters (20 8) set it to 0.35. C i a, a t oug we do ot rigorous y esti ate ϵ ere, a regressio of og-e pe diture s ares o og-i co e suggests a va ue betwee 0.8 a d .0. We opt for 0.7. e va ue of γ is set to 0.3, c ose to Boppart (20)'s esti ate of 0. a d Ec ert a d Peters (20 8)'s of 0.32. We s ow t at our resu ts are robust to a ter ative va ues for ϵ a d γ i t e appe di . Fi a y, t e o g-ru s are of spe di g a ocated to agricu ture ϕ is set to 0, w ic si p i es Eq. (23) wit very itt e qua titative effect o our resu ts, as we de o strate i t e appe di .

4.2. m m

We rst esti ate t e size of igratio cost c a ges before qua tifyi g its effect o growt , structura c a ge, a d re-gio a co verge ce. additio , we co pare our ai resu ts to a ode wit ot etic prefere ces a d to esti ates based o a a ter ative de itio of igratio .

[5] We use t is approac to e i ai ate t e gaps i e p oy e t betwee t e ce sus a d CSY. e C i ese popu atio ce sus a d t e NBS abor survey, t e source of t e e p oy e t data i CSY, use differe t survey et ods i e u erati g agricu tura a d o -agricu tura e p oy e t. e ce sus provides ore accurate i for atio about igratio , but ess accurate i for atio o e p oy e t. We discuss t is i ore detai i t e data appe di .

[6] For robust ess, we a so report t e resu ts wit registered wor er c a gi g for eac ve year period i t e appe di , a d our ai resu ts do ot c a ge uc .

Table 3
verage igratio costs i C i a.

	verage cost				e ative to 2000		
Year	2000	2005	20 0	20 5	2005	20 0	20 5
Overa , c udi g δ	3.96	3.59	2.90	2. 7	0.9	0.73	0.55
Direct igratio costs μ	.75	.63	.3	0.96	0.93	0.75	0.55
A *N* μ							
Overa	2.68	2.23	.57	.0	0.83	0.58	0.39
Wit i Provi ces	2.25	.87	.32	0.87	0.83	0.59	0.39
Betwee Provi ces	.38	9.55	5.95	.88	0.8	0.52	0.3
B μ							
Overa	9.	8.00	5.5	3.68	0.88	0.6	0.0
Wit i gricu ture	.6	3.8	0.62	.99	. 6	0.9	.29
Wit i No agricu ture	5.67	5.06	.	.92	0.89	0.73	0.3

Note: Disp ays t e weig ted-average igratio cost for various years a d various types of igratio oves. T e ast t ree co u s disp ay t e igratio costs i eac year re ative to 2000. igratio costs disp ayed are e c usive of t e forego e retur s to a d a d capita t at accrue o y to o igra t oca s, e cept for t e rst row t at i cudes t is i t e average.

4.2.1. E m m

Wit t e ca ibrated para eters a d our data o rea i co es, e p oy e t, registratio s, a d igratio s ares, we i fer t e fu atri of bi atera igratio costs betwee provi ces a d sectors. Speci ca y, we so ve for t e direct igratio costs μ suc t at Eq. (24) o ds, a d fro Eq. (23), we ca ca cu ate t e igratio cost as fo ows:

$$\mu = - \left(\frac{m}{m} \right)^{- /\kappa} = \underbrace{\frac{/\epsilon - (\psi \cdot - \alpha\phi)/\gamma}{\delta^{\epsilon}/\epsilon - (\psi \cdot - \alpha\phi)/\gamma}}_{\text{No ot eticity a d rebates}} \underbrace{\left(\frac{v}{v} \right)^{\epsilon} \left(\frac{m}{m} \right)^{- /\kappa}}_{\text{Overa Cost}} \tag{26}$$

We use data o rea GDP by provi ce a d sector to esti ate rea wages a d a d a d capita rebates, usi g Eq. (20), a d data o co su ptio s ares by provi ce a d rura or urba area to esti ate agricu tura spe di g s ares. Wit t ese esti ates i a d, we report t e resu ti g igratio -weig ted average igratio costs i T ab e 3.

T e average of t e direct igratio costs wa

of

average

Table 4
Effect of ower igratio costs, 20

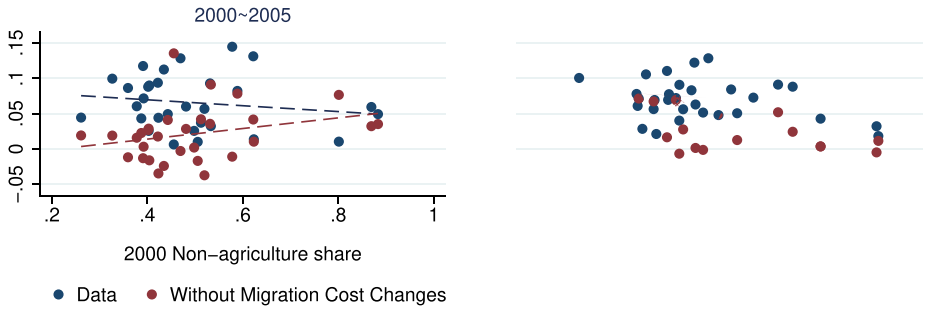

2000~2005
−.05 0 .05 .1 .15
.2 .4 .6 .8 1
2000 Non−agriculture share
Data
Without Migration Cost Changes

Table 5
verage igratio costs i C i a (ot etic prefere ces).

	verage cost				e ative to 2000		
Year	2000	2005	20 0	20 5	2005	20 0	20 5
Overa , c udi g δ	5.86	5.00	3.73	2.47	0.85	0.64	0.42
Direct igratio costs μ	3.02	2.5	.76	.09	0.83	0.58	0.36
A N μ							
Overa	3.93	3. 2	.89	.05	0.79	0.48	0.27
Wit i Provi ces	3.23	2.56	.56	0.85	0.79	0.48	0.26
Betwee Provi ces	27.47	23.05	2. 8	9.27	0.84	0.44	0.34
B μ							
Overa	25.43	2 .89	2.93	7.68	0.86	0.5	0.30
Wit i gricu ture	43.42	39.87	35.65	54.3	. 5	0.82	.25
Wit i No agricu ture	9.07	6.70	2.75	4.4	0.88	0.67	0.23

Note: Disp ays t e weig ted-average igratio cost for various years a d various types of igratio oves. T e ast t ree co u s disp ay t e igratio costs i eac year re ative to 2000. igratio costs disp ayed are e c usive of t e forego e retur s to a d a d capita t at accrue o y to o -igra t oca s, e cept for t e rst row t at i c udes t is i t e average.

Table 6
Effect of ower igratio Costs, 2000–20 5 (ot etic prefere ces).

	Five-year growt (%) for year e di g			Cu u ative
C m	2005	20 0	20 5	effect
ggregate ea GDP Growt	2.8	4.9	6.	4.4
Provi cia equa ity	−4.2	− 3.8	− 8.9	−33.0
gricu tura Bp oye e t S are	−2.	−4.7	−7.7	− 4.6
C A N - , - M C				
ggregate ea GDP Growt	.8	2.3	3.3	7.6
Provi cia equa ity	0.4	−3.	−6.8	−9.3
gricu tura Bp oye e t S are	− .8	−3.	−6.	− .0
C A N - , B - M C				
ggregate ea GDP Growt	.3	3.0	2.3	6.7
Provi cia equa ity	−4.6	− 0.9	− 2.9	−25.9
gricu tura Bp oye e t S are	−0.8	−2.2	−2.0	−4.9

Note: Disp ays t e effect of c a gi g igratio costs i eac of t e t ree ve-year periods e di g 2005, 20 0, a d 20 5. T e cu u ative effects wit be c ar ode a d ot etic-prefere ce ode are reported i t e ast two co u . C a gi g ag to o -ag igratio costs affects ove betwee agricu ture a d o -agricu ture o y. T is is furt er deco posed i to its wit i -provi ce a d betwee -provi ce co po e ts. T e c a ge i regio a i equa ity is reported as t e c a ge i t e vari- a ce of og rea GDP per wor er across provi ces. T e c a ge i agricu ture's s are of atio a e p oye e t is reported as t e perce tage poi t c a ge.

Table 7
tra-provi cia wor er igratio i C i a, 2000–20 5.

	Broad de itio				ter-cou ty			
	2000	2005	20 0	20 5	2000	2005	20 0	20 5
ota igra t Stoc	0 .5	32.6	76.2	2 5.7	2.8	5.4	27.3	33.5
Em m (%)								
ota igra ts	4.	7.8	22.9	28.0	.78	2.06	3.55	4.3
g-to-No ag igra ts	3.0	6.5	2 .6	25.5	.73	2.02	3.50	4.25

Note: Disp ays t e u ber of wor ers ivi g a d wor i g outside t eir area of registratio . T e rst row is i i io s. T e ast two rows are s ares of tota e p oye e t.

or tow s ip, w ic suggest pote tia y arge frictio s to switc i g sectors oca y. Our broad de itio of igratio captures t e reductio i t ese frictio s as c a ges i i tra-provi cia igratio costs. ere we e p ore a a ter ative a d stricter de itio of i tra-provi cia igratio . y wor er w o switc es sectors wit i a provi ce wi be c assi ed as a igra t wor er o y if t e wor er is outside t eir cou ty of registratio . For wor ers wor i g wit i t eir registratio cou ty, we assu e t ere is o e p icit or i p icit cost of switc i g sectors. T at is, t ey ca switc sectors wit out cost a d are e tit ed to receive a d a d capita i co e rebates fro t e sector t ey wor i .

Tab e 7, we co pare t e igratio stoc s u der t e ew de itio wit t ose u der our origi a de itio . T e i tra- provi cia igratio decreases by arou d 85 perce t co pared to t e broad de itio . owever, i e t e origi a de itio ,

Table 10
C a ges i i ter a a d e ter a trade costs i C i a, 2002–20 2.

	E porter								
porter	Nort - East	Beiji g- ia ji	Nort Coast	Ce tra Coast	Sout Coast	Ce tra egio	Nort - West	Sout - West	broad
C	C	, 2002	2007						
Nort east	.00	0.90	0.93	0.95	. 2	.0	0.90	. 9	0.85
Beiji g/ ia ji	0.90	.00	0.95	0.87	.0	0.92	0.82	.03	0.80
Nort Coast	0.93	0.95	.00	0.9	.06	0.98	0.87	.06	0.82
Ce tra Coast	0.9	0.87	0.90	.00	0.90	0.88	0.79	0.99	0.83
Sout Coast	. 2	.0	.06	0.9	.00	0.85	0.82	0.80	0.90
Ce tra egio	.00	0.92	0.97	0.88	0.8	.00	0.8] J 0.0 39 c /F	f 6.376	0 0 6.37676 w753 56

Nort east	.00	87	288	.9	0.99	0.99	.8	0.83

t-76(e)2 23(r)2B( )2a 0

Nort	0.99	0.0	0.8] J 0.0 39 c /F	f 6.376	0 0 6.3 2	8.75588	52.32639	[( )] J 0.0 39 c /F f

Coas

Beiji g/ ia ji	88	.00	93	.97	.8	88	93	0.99

Sou J 0 c /F2 f 6.376 0 0 6.376 2 .7386393254 739 [93] J -0. .09 c- 32 8 L /8 f 6.376 0 0 .62376 55 .32287 0.9 738389 [(No)- 3.3(r)- (t)- 2.5

. H ,

Table 13
Effect of capita ar et c a ges, 2000–20 5.

	Five-year growt (%) for year e di g		Cu u ative	ot etic
	2005	20 0	20 5	

Table 14
Decomposing China's growth, income convergence, and structural change.

	Five-year change			Share of five-year change (%)		
	2005	2010	2015	2005	2010	2015
A. GDP G (%)						
Data	63.	65.0	36.3			
Overall	5.3	55.0	3.9	00.0	00.0	00.0
Productivity Changes	38.	5 .9	8.0	69.5	95.8	7.3
Inter-Trade Costs	8.3	− .8	–	5.9	−.7	–
Enter-Trade Costs	.7	−0.	–	9.2	−0.	–
Migration Costs	.	5.5	6.5	8.0	0.6	20.3
Capital Wedges	0.5	−0.	−0.5	0.7	−0.	− .7
Average Real Capital Cost Changes	− .7	−0.5	0.9	−3.3	− .2	3.
C. Aggregate Employment (%)						
Data	−8.2	−8.	−8.			
Overall	−5.	−8.	−6.3	00.0	00.0	00.0
Productivity Changes	− .6	−3.	.6	32.5	37.0	−2.6
Inter-Trade Costs	0.	0.2	–	− .6	−2.5	–
Enter-Trade Costs	−0.3	0.0	–	5.7	−0.6	–
Migration Costs	−3.2	−5.6	−7.7	63.3	66.	2 .
Capital Wedges	0.0	0.0	0.0	0.9	−0.2	0.5
Average Real Capital Cost Changes	0.0	0.0	−0.2	−0.7	−0.	3.
C. GDP / Income (%)						
Data	.3	− .2	−3 .8			
Overall	0.9	− 2.0	−3 .9	00.0	00.0	00.0
Productivity Changes	7.2	−2.	− .6	57.6	7.6	5.7
Inter-Trade Costs	6.3	−.0	–	57.5	33.6	–
Enter-Trade Costs	2.8	2.	–	26.0	- 7.7	–
Migration Costs	− 3.	− .2	− 8.	− 9.	8.8	56.6
Capital Wedges	−2.	6.2	0.8	−2 .9	−52.2	−2.6
Average Real Capital Cost Changes	0.0	0.0	−0.	0.	−0.	0.3

Note: Displays the growth in China's aggregate real GDP and the change in agriculture's share of employment over the three five-year periods ending 2005, 2010, and 2015. Each row displays the marginal contribution to growth of each counterfactual change in inter-trade costs, enter-trade costs, migration costs, capital wedges, and aggregate capital/output across all permutations of those changes. Changes in employment shares are the percentage point change in agriculture's share of total employment. Changes in provincial inequality reflect the percent change in the variance of log real GDP per worker.

increased significantly after its accession to WTO. Since 2005, and especially after 2010, there had been convergence in TFP across provinces and sectors that also contributed to the decline in regional inequality.

5. Conclusion

Using unique yet detailed data on production, employment, capital, trade, and migration, we decompose the various contributing factors behind China's growth, structural change, and income convergence between 2000 and 2015. particular, by combining rich individual-level data on worker location and occupation decisions from 2000 to 2015 with a spatial general equilibrium model of China's economy, we quantify the size and consequences of policy-driven reductions in inter-area migration costs. We find that between 2000 and 2015 migration costs fell by 5%, with the cost of moving from agricultural rural areas to non-agricultural urban homes falling more. Through a variety of quantitative exercises, we demonstrate that these migration cost changes account for the majority of the drop in regional inequality and the reallocation of workers out of agriculture. We compare the effect of migration policy changes with other important economic development efforts in China, including changes in trade costs, capital market distortions, aggregate capital cost reductions, and productivity. While each contributes meaningfully to growth, migration policy is central to China's structural change and regional convergence. We also find that a notably slower pace of between-sector and between-province migration after 2010 and increasing restrictions on credit paths and capital accumulation ingenerating growth in recent years. Given the importance of inter-area migration to China's economic development that we

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