Aggregate Employment and the Rise of Services across Time and Countries[†]

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Abstract

We document substantial changes in the ratio of aggregate employment to working-age population across countries that are not systematically related to the level of development or growth. These changes in aggregate employment are strongly associated with the evolution of services. We assess the quantitative contribution of changes in aggregate employment to the rise of services using an otherwise standard model of sectoral reallocation calibrated to time-series for the United States. The calibrated model implies a high elasticity of changes in aggregate employment to employment in services: across countries a one percentage point change in aggregate employment generates a 0.7 percentage point change in services, a result robust to alternative specification of preferences and calibrations. The changes in aggregate employment account for one-third of the rise of services across countries.

JEL classification: E1, E24, J11, J16, J21, J22, O11, O41, O51.
Keywords: employment, goods, services, productivity, structural transformation, working-age population.

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1 Introduction

We study the substantial process of sectoral reallocation across time and countries. For instance, in the United States between 1960 and 2000, the employment to working-age population (employment ratio) in the services sector increased from 42 to 62 percent (a 20 percentage point increase). There are also substantial increases in the employment ratio in services in many countries. While there is a large literature emphasizing the role of aggregate productivity growth and sectoral productivity differences for structural transformation, in this paper we highlight the contribution of changes in aggregate employment (the employment to working-age population), which we document are substantial across countries, on the evolution of services.

What is the contribution of changes in aggregate employment to the rise of services over time and across countries? To answer this question, we first construct a dataset combining the 10-Sector database (Timmer et al., 2015), the EU-KLEMS database (Van Ark and Jäger, 2017), the Penn World Table (Feenstra et al., 2015), and the World Development Indicators (World Bank, 2022); to document changes in aggregate employment (the employment to working-age population) and sectoral allocation across 57 countries spanning the world income distribution roughly between 1960 and 2010. We document striking changes over time in the employment ratio across countries. In the United States between 1960 to 2000, the employment ratio increased from 0.66 to 0.78 (+12 p.p.), across countries the changes range between −15 and +20 percentage points. We also show that these changes in aggregate employment are strongly associated with the evolution of services.

We then consider a standard two-sector general-equilibrium model of sectoral reallocation between goods and services featuring exogenous variations in aggregate employment. We calibrate model to time-series data for the United States and use the calibrated model to perform cross-country analysis. We use the quantitative model to assess sectoral employment

in a counterfactual where aggregate employment is constant at the initial period in each country. We then compare the difference between the employment ratio in services in the last period for each country in the model and the counterfactual with the change in aggregate employment (which is also the difference in the last period between the aggregate employment in the model and counterfactual). We find that the calibrated model implies a high elasticity, around 0.7, of services employment to changes in aggregate employment. Across countries, a 1 percentage point change in aggregate employment generates a 0.7 percentage point change in services. We also show that the patterns of evolution in aggregate and services employment are consistent in time series data for each country. The changes in aggregate employment account for at least one-third of the rise in services across countries.

Our results suggest that changes in aggregate employment can be a substantial driver of sectoral reallocation in countries where the employment ratio remains low, especially for women. At the same time, for countries that have already achieved a relatively high employment ratio, this source of growth in service employment does not contribute much to services growth as it has been the case in the United States since the early 2000s (Duarte, 2020).

Our paper relates to three related strands of the literature. First, the broad literature on structural transformation (Kuznets, 1966; Baumol, 1967; Kongsamut et al., 2001; Ngai and Pissarides, 2007; Duarte and Restuccia, 2010; Herrendorf et al., 2014). Second, the literature on the evolution of aggregate employment such as Prescott (2004), Rogerson (2008), Ngai and Pissarides (2008), Bick et al. (2022), Duarte (2020), among others. Third, the specific literature on the rise of services (Buera and Kaboski, 2012; Ngai and Petrongolo, 2017). We differ from these literatures by emphasizing another driver of employment reallocation: changes in aggregate employment not necessarily connected with the process of development; and focus on the reallocation across time and countries.

Our work relates closely to that of Rogerson (2008) considering the role of productivity catch

up and the increase in taxes in Europe relative to the United States as important drivers of both the decline in market hours of work in Europe relative to the United States and the more muted increase in market services in Europe. Our analysis considers the change in aggregate employment as exogenous primarily because the causes of its evolution are likely to be country specific, such as the role of taxes in Europe, or related to other factors such as differential decline in discrimination barriers towards women's labor force participation. More importantly, whereas Rogerson (2008) emphasizes the combined role of taxes and productivity convergence on the sectoral patterns in Europe, we note the direct effect on the evolution of services employment of changes in aggregate employment in the context of a standard model of sectoral reallocation.

The paper is organized as follows. In the next section, we document changes in aggregate and sectoral employment overtime across a large set of countries. Section 3 describes the model of structural transformation we use and calibrates the economic forces determining the level and evolution of sectoral employment to data for the United States. We also calibrate initial sectoral productivity differences across countries to the differences in real income per capita and sectoral employment allocations. Sectoral productivity growth rates and aggregate employment ratios are directly pin down by data across countries. In section 4, we assess the quantitative role of changes in aggregate employment across countries for the rise in services. Section 5 concludes.

2 Empirical Evidence

We describe the construction of our main dataset, including the sources of data and variable definitions, and discuss a number of facts about employment across sectors, countries and time. These facts serve as motivation for the quantitative analysis that follows.

2.1 Data Description

Our dataset combines data from the 10-sector (Timmer et al., 2015) and the EU-KLEMS (Van Ark and Jäger, 2017) datasets, with information on employment and value added data by sector; the World Development Indicators database (World Bank, 2022) where we collect the working-age (15-65 year old) population; and the Penn World Table (PWTv10.0) (Feenstra et al., 2015) for real GDP per capita. We also use data from ILOSTAT database (International Labour Organization, 2022) to obtain employment by gender although in this dataset the time span is restricted to 1991 to 2007. The final dataset contains 56 countries spanning a substantial portion of the cross-country income distribution roughly over the period 1960 to 2010. For countries in the EU-KLEMS, the time period is 1970 to 2007.

Our main data source for employment and value added across sectors and countries is the 10-sector database (Timmer et al., 2015). We complement this data with working-age population (15-65) from the World Bank's World Development Indicators. The data comprise 39 countries covering 1960 to 2010 for most countries. In the 10-sector database, employment refers to persons engaged which includes not only employees but also self-employed and family workers. The data rely on population censuses as well as labor force surveys and business surveys to maximize comparability across time and space.

In our analysis, we focus on a sectoral decomposition between goods and services. Goods include: Agriculture, hunting, forestry and fishing (AtB); Mining and quarrying (C); Manufacturing (D); Electricity, gas and water supply (E); Construction (F). Services include: Wholesale and retail trade, hotels and restaurants (GtH); Transport, storage, and communication (I); Finance, insurance, real estate and business services (JtK); Government services (LtN); Community, social and personal services (OtP).

We use the same data source and decomposition to calculate real value added per worker in the two sectors for all the countries in our sample, where real refers to constant domestic

price over time in each country. The data for value added comes from national accounts and is considered to be of high quality. Using our measures of real value added per worker we compute average yearly growth rates by sectors and countries, although we emphasize that our results are robust to instead using year-by-year growth rates in each sector and country.

2.2 Observations

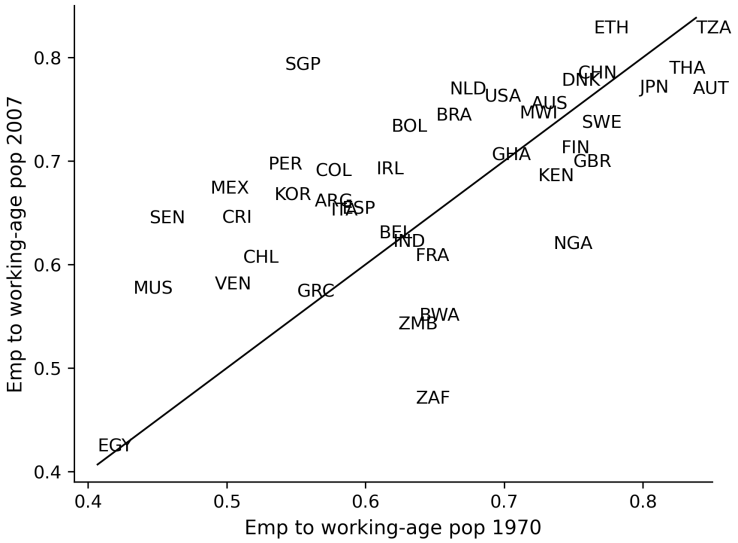
We emphasize the following two facts. First, there are substantial changes in aggregate employment (employment to working-age population) across countries and these changes are not systematically related to the level of per-capita income or growth. Second, changes in aggregate employment are strongly associated with the evolution of employment in services across time and countries.

We also note that changes in aggregate employment are also associated with changes in female employment, but it is not the only source of variation as in some countries there are substantial changes in male employment as well.

Changes in aggregate employment. We start by describing the changes in the employment to working-age population ratio across countries in our sample. We refer to the employment to working-age population ratio and the employment ratio or aggregate employment indistinguishably in what follows unless otherwise noted. Figure 1 documents the employment ratio in 1970 against the employment ratio in 2007 for all the countries in our sample. We report the period 1970 to 2007 that includes data for all countries, however a similar pattern of variation arises when focusing on the 1960 to 2010 period.

Figure 1 shows both the wide differences in employment ratios across countries and the variation in this ratio over time (Rogerson et al., 2001; Rogerson, 2006). For instance, in 1970 the employment ratio was as low as 40 percent in Egypt and as high as 85 percent in Tanzania,

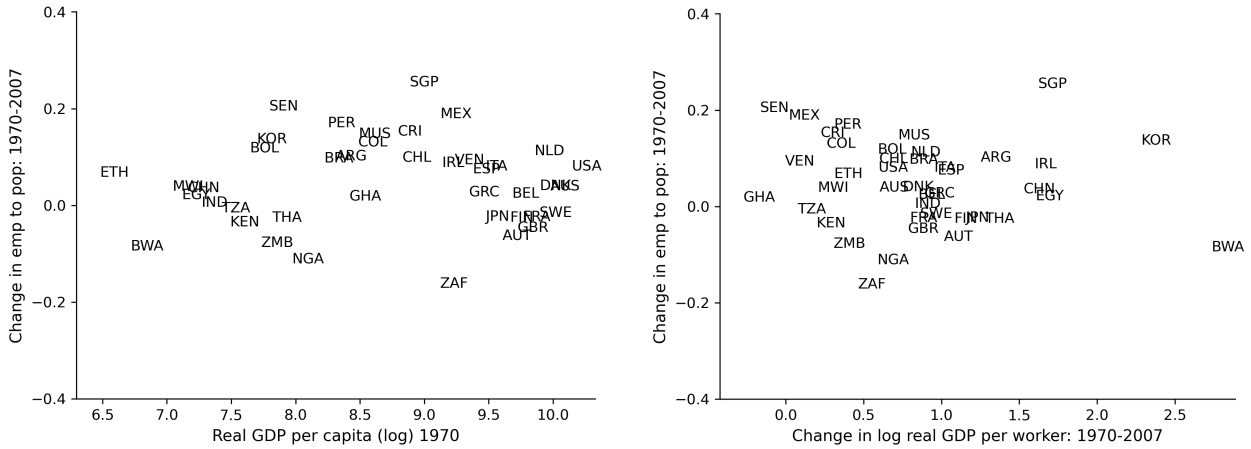
Figure 1: Employment to Working-age Population across Countries



whereas in the United States this ratio was around 65 percent. In 2007, the employment ratio was roughly constant for several countries such as Egypt, Argentina, Spain and Denmark; decline for several countries by 5 percentage points or more such as South Africa, Zimbabwe, Nigeria, Germany and Japan; and strongly increased for most other countries, with several countries increasing by more than 10 percentage points such as Senegal, Mexico, Peru, and the United States.

Consistent with well-known development facts, aggregate employment differences are not systematically related with the level of development. More importantly, the changes in aggregate employment are not systematically related to the level of income per capita or growth in labor productivity. Figure 2 documents the lack of systematic relationship between changes in the aggregate employment ratio between 1970 and 2007 and real GDP per capita in 1970 across countries (left panel) and the growth in labor productivity across countries (right panel). The correlation between changes in aggregate employment and the level of income is 0.02, whereas with growth is slightly negative (-0.11).

Figure 2: Changes in Aggregate Employment, Income, and Growth

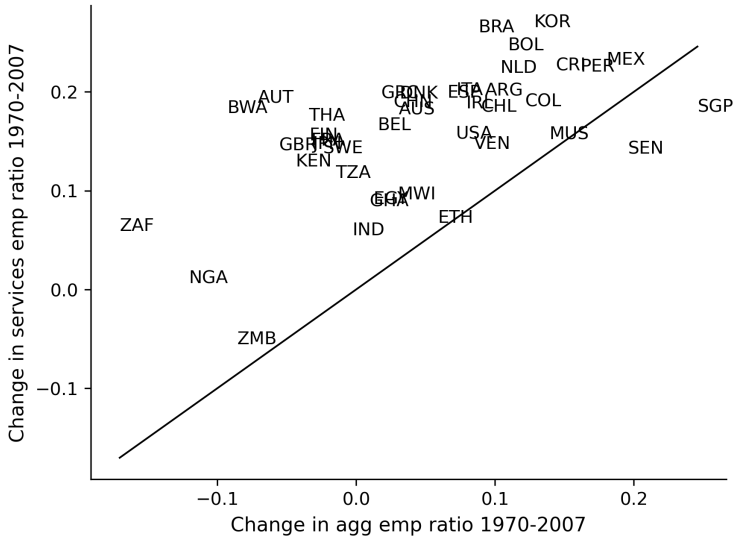


Notes: The figure reports the relationship between changes in the aggregate employment ratio and the level of development (real GDP per capita) in the left panel and growth in labor productivity in the right panel.

Aggregate employment and the rise of services. Changes in aggregate employment are strongly related to the increase in employment in services across countries. Figure 3 documents the patterns of the change in the employment ratio between 1970 and 2007 and the corresponding change in employment in services. Figure 3 illustrates that countries with no increase or decline in the aggregate employment ratio show weak or no structural change, whereas countries with substantial increases in the aggregate employment ratio show a disproportionate reallocation towards services. Changes in aggregate and services employment highly correlated across countries, rising services in most countries.

Employment in services rises because of income and substitution effects associated with the process of structural change as emphasized in the vast literature (Kongsamut et al., 2001; Baumol, 1967; Ngai and Pissarides, 2007). Disentangling the effect of traditional forces of structural change such as sectoral and aggregate productivity growth and changes in aggregate employment is an important feature in our quantitative analysis. But the evidence from time series of individual countries suggests a stronger (weaker) process of structural change towards services in countries where aggregate employment increased (decreased). For instance, Figure 4 shows the evolution of aggregate and sectoral employment ratios in four

Figure 3: Changes in Aggregate Employment and the Evolution of Services across Countries



countries: Chile (CHL), Spain (ESP), Mexico (MEX), and the Netherlands (NLD). In all these countries we observe a period of either stable or declining aggregate employment and then strongly rising, which is associated with relatively minor reallocation to services and then strongly increasing. The evidence is suggestive of the connection between the strength of changes in aggregate employment and the extent of reallocation of employment to services.

Role of female employment A question that arises is what drives these changes in the aggregate employment ratio across countries. We have already noted that changes in aggregate employment are not systematically related with the level of development or growth in labor productivity. An important feature in many countries appears to be the increase in female labor force participation potentially associated with declining barriers to female employment across countries, as suggested by the evidence of changes in broad discrimination barriers for the United States in Hsieh et al. (2019), see also Ngai and Petrongolo (2017) for the role of structural transformation and marketization of services on female labor market outcomes in the United States. Duarte (2020) documents the evolution of employment ratios in the aggregate and by gender in the United States since 1960, illustrating how convergence

Figure 4: Aggregate Employment and Services over Time, Some Countries

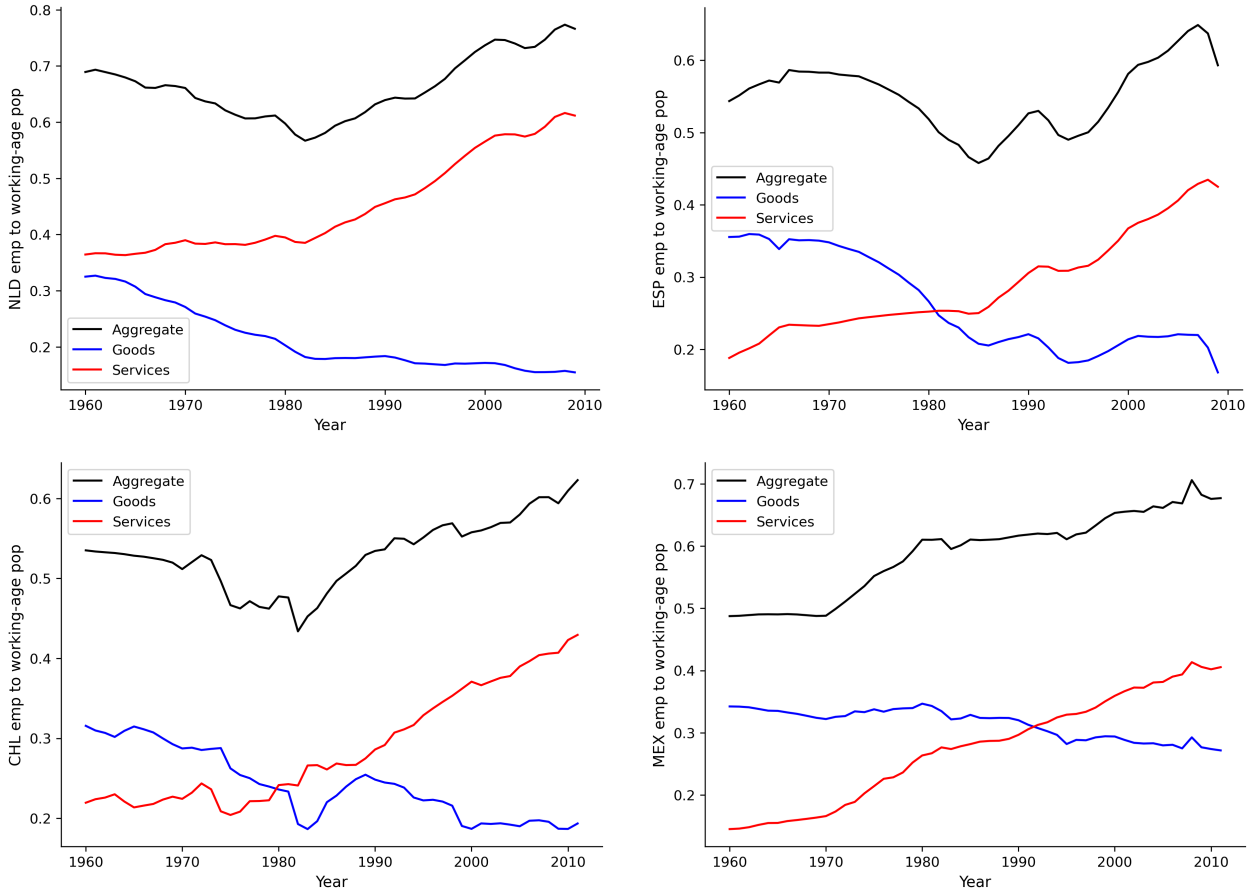
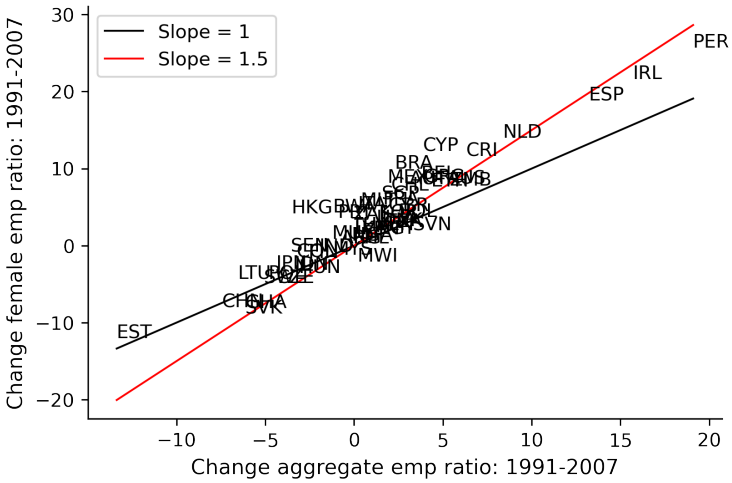


Figure 5: Changes in Female and Aggregate Employment across Countries



of female employment to males's accounts for most of the increase in the aggregate employment ratio until about the year 2000 where convergence stagnated at around 85 percent female to male employment (see also Fukui et al., 2018). But note that for many countries we observe decreases in the employment ratio, suggesting other sources of variation such as changes in taxes in Europe relative to the United States (Prescott, 2004; Rogerson, 2008).

Figure 5 documents the change in the aggregate employment ratio against the change in the female employment ratio between 1991 and 2007 across countries. Note that the time period and sample of countries in this figure differs slightly from our baseline sample since female employment is obtained from the ILO which is not available for some countries and before 1991. For many countries, observed changes are in the 45 degree line which indicates that the change in female employment is similar to that of males. Other countries with substantial increases in female employment are closer to the 1.5 degree line which indicates that female employment is the main driver of aggregate employment. Note also that for several countries, there is a decline in female employment but for these countries the decline is shared among men as well.

3 Model

We consider a standard general-equilibrium model of structural transformation (Rogerson, 2008; Duarte and Restuccia, 2010). At each date, two commodities are produced in sectors (goods and services) with linear technologies in the labor input. Employment reallocation across sectors, structural transformation, is driven by an income effect due to non-homothetic preferences, a substitution effect due to differential sectoral productivity growth, and changes in the aggregate employment ratio. We calibrate the key parameters of the model to data for the United States which provides discipline to the economic forces in the model. We then show that observed sectoral productivity growth and changes in the employment across countries capture the salient features of observed cross-country changes in sectoral employment allocations. We use the model to evaluate the quantitative importance of changes in aggregate employment on the reallocation of employment across sectors.

3.1 Description

Production. In each period, two commodities are produced: goods (g) and services (s) according to the following constant returns to scale production functions:

$$Y_i = A_i L_i, \qquad i \in \{g, s\}, \tag{1}$$

where Y_i is output in sector i, L_i is labor input in sector i, and A_i is a sector-specific technology parameter. Note that the parameter A_i corresponds to labor productivity in the data and movements over time can arise from changes in sector TFP or capital intensity. The source of this variation is not critical for our analysis, although we are also limited by capital stock data across sectors and countries.

Households. The economy is populated by an infinitely-lived representative household of constant size. The household is endowed with L units of time each period which are supplied inelastically to the market. The stand-in household has standard preferences over aggregate consumption, but aggregate consumption is defined implicitly by the following non-homothetic CES utility (Comin et al., 2021):

$$C_t = \left[(1-a)^{\frac{1}{\sigma}} C_t^{\frac{\epsilon_g - 1}{\sigma}} c_{g,t}^{\frac{\sigma-1}{\sigma}} + a^{\frac{1}{\sigma}} C_t^{\frac{\epsilon_s - 1}{\sigma}} c_{s,t}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}},$$

where $\sigma \geq 0$ controls the elasticity of substitution between goods and services and $\epsilon_i > 0$ controls the income elasticity of consumption in each sector. Note that when $\epsilon_i = 1$, this function becomes a standard CES aggregator of goods and services consumption. In addition, when $\sigma = 1$ then this is a standard Cobb-Douglas utility with weights a and $(1-a)$ for services and goods. As a result, the values of σ and ϵ_i determine the strength of standard income and substitution effects driving structural transformation.

Market structure. We assume a continuum of homogeneous firms in each sector that are competitive in output and factor markets. At each date, given the price of commodity i, p_i, and wages w, a representative firm in sector i chooses the labor input to maximize profits. The household chooses consumption allocations to maximize utility subject to the budget constraint,

$$p_{g,t} c_{g,t} + p_{s,t} c_{s,t} = wL,$$

taking prices and the wage rate as given. Note that just as with sectoral productivity growth which drives growth in per capita income via changes in w, changes in aggregate employment L also generate income effects, a feature often abstracted in studies of structural transformation.

Equilibrium. The model is a sequence of static employment allocation problems. Market clearing implies that

$$c_g = A_g L_g, \quad c_s = A_s L_s, \quad L = L_g + L_s.$$

Normalizing the wage rate to 1, the firms' problem implies that prices are given each period by

$$p_i = \frac{1}{A_i}, \qquad i \in \{g, s\}. \tag{2}$$

The first-order conditions for the household problem together with equilibrium prices and market clearing imply that reallocation across sectors features income and substitution effects as follows:

$$\frac{L_s}{L_g} = \frac{p_s c_s}{p_g c_g} = \frac{a}{(1-a)} \left(\frac{p_s}{p_g}\right)^{1-\sigma} C^{\epsilon_s - \epsilon_g},$$

where the ratio of employment across sectors is equal to the ratio of consumption expenditures that depend on weights, the effect of relative prices given σ, and the income effect given given the relative income elasticities across sectors. Since in this case only the relative income effect matters, we denote $\epsilon = \epsilon_s - \epsilon_g$ as the relevant parameter to restrict. While the qualitative implications of substitution and income effects are similar to that emphasized in the literature (e.g., Echevarria, 1997; Kongsamut et al., 2001; Ngai and Pissarides, 2007), the non-homothetic CES specification provides more flexibility for quantitative analysis across countries. Nevertheless, we note that our quantitative results are similar if instead we calibrate generalized Sone-Geary preferences as in Rogerson (2008), and Herrendorf et al. (2014).

3.2 Calibration

United States. We calibrate the key parameters of the model to be consistent with the process of structural transformation in the United States given exogenous average sectoral

productivity growth γ_i and changes in the aggregate employment ratio L_t.

The time path for labor productivity can be characterized as follows in each sector,

$$A_{i,t+1} = (1 + \gamma_i)A_{i,t}, \qquad i \in \{g, s\},$$

with $A_{i,0}$ normalized to one in 1960. Recall that the average growth rates of labor productivity are calculated using Hodrick-Prescott filtered data for real value added and employment in each sector. We note our results are similar when using instead the year-to-year growth rates rather than the average.

We map L_t to the employment to working-age population ratio in the data. We set $\sigma = 0.1$ consistent with complementarity between goods and services as estimated in the literature (Comin et al., 2021; Sposi et al., 2021). We then calibrate ϵ and a to match the sectoral employment ratios in 1960 and 2000. The calibrated $\epsilon = 1$ is also within the ranges estimated in the literature. Table 1 reports the calibrated parameter values.

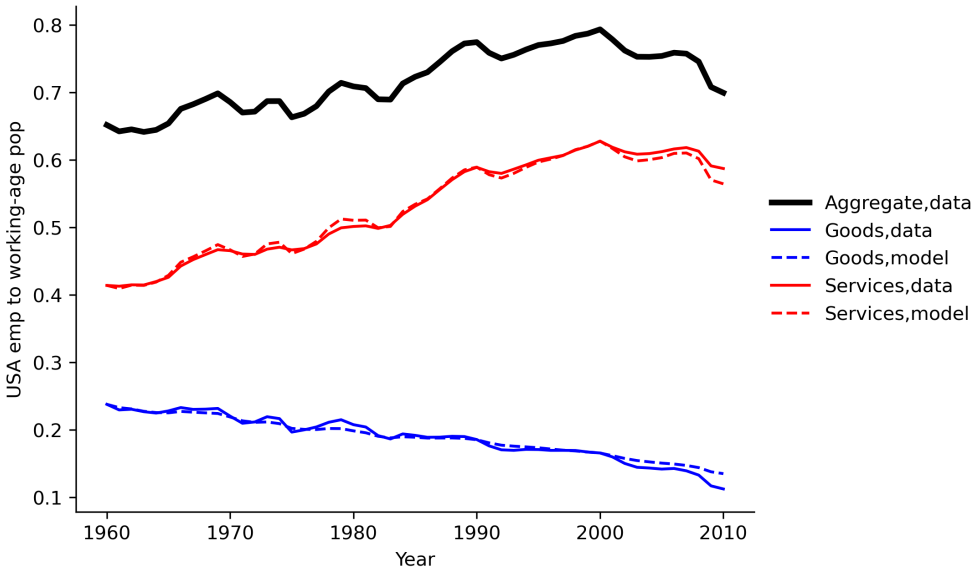
Table 1: Calibration to U.S. Data

Parameter	Value	Target U.S. data
$A_{i,60}$	1.0	Normalization
γ_g	{data (2.4%)}	Average labor productivity growth in goods
γ_s	{data (1.5%)}	Average labor productivity growth in services
L_t	{data}	Aggregate employment ratio
σ	0.10	Complementarity, consistent with estimates in literature
ϵ	1	Sectoral employment ratios 1960, 2000
a	0.41	Sectoral employment ratios 1960, 2000

The model reproduces very well the process of structural change in the United States during the sample period. Figure 6 reports the employment ratios in goods and services implied by the model (dashed lines) and in the data (solid lines), along side the aggregate employment ratio. Given constant sectoral labor productivity growth and the aggregate employment ratio, the model captures fairly well the reallocation of employment from goods to services

observed in the United States between 1960 and 2010. While the calibration is designed to match the change in employment ratios across sectors between 1960 and 2000, overall the model does a good job capturing the year-by-year changes in the sectoral ratios.

Figure 6: Sectoral employment ratios, United States



Other countries. We simulate the structural transformation for other countries in our sample assuming the same preference parameters as calibrated for the United States, but given their own average sectoral labor productivity growth and their own evolution of the aggregate employment ratio. That is, for each country we calibrate the country specific growth rates γ_i and the aggregate employment ratio L_t. We also calibrate the level of the two initial sectoral labor productivities, $A_{i,60}$. For each country, we calibrate the two parameters to match the employment ratio in goods in 1960 and aggregate labor productivity in 1960 relative to the United States.

Figure 7 documents the sectoral labor productivity growth rates in goods and services across countries observed in the data, with the dashed red lines indicating the sectoral growth rates of the United States as reference. As emphasized in Duarte and Restuccia (2010), for most

countries the productivity growth rates are higher in goods than in services and there is substantial variation in growth rates across countries.

Figure 7: Cross-country growth of sectoral productivity

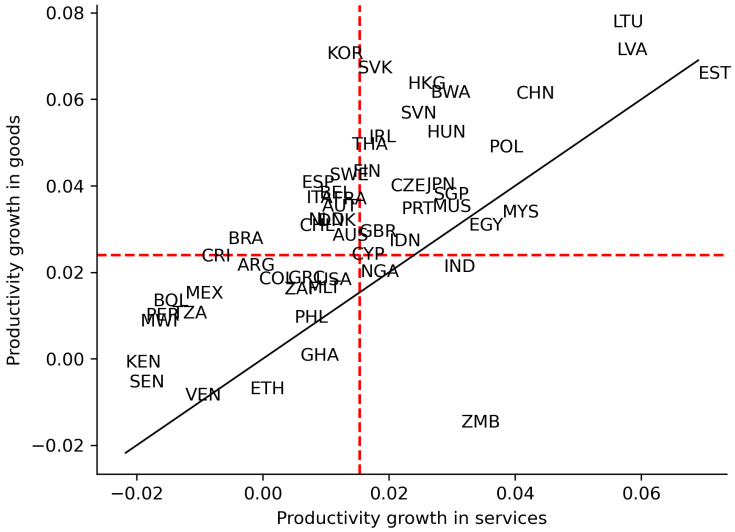
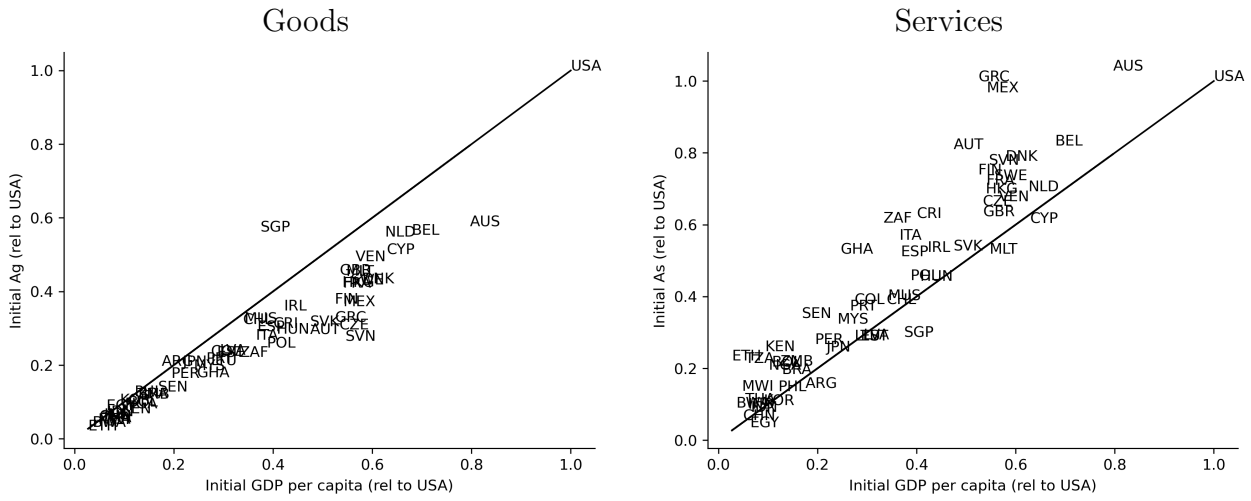


Figure 8 documents the implied level of sectoral productivity across countries calibrated to the initial allocation of employment across sectors and real income per capita differences across countries. As is commonly found in the literature, the implied sectoral productivity differences are larger in goods than in services (Restuccia et al., 2008; Duarte and Restuccia, 2020; Herrendorf et al., 2022).

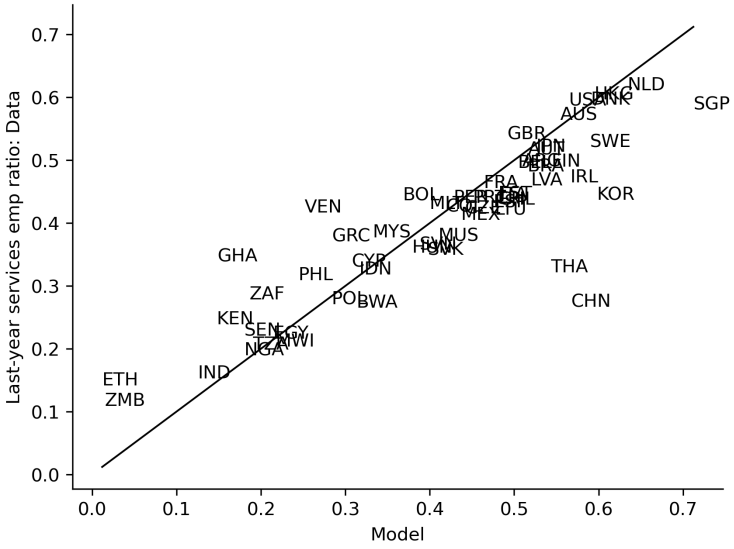
Performance. We now describe how the model performs in terms of generating the reallocation of labor across sectors given the country-specific growth rates and changes in aggregate employment. Figure 9 summarizes the performance of the model in capturing the reallocation of employment across sectors in all countries by reporting the employment ratio in services in the last year in the sample for all countries in the data and the model. The solid line represents the 45 degree line where model and data exactly line up. Figure 9 illustrates that the model is able to broadly capture the reallocation of employment towards services in most countries, with China, Korea, Thailand, and Singapore being somewhat outliers in

Figure 8: Cross-country initial sectoral productivity



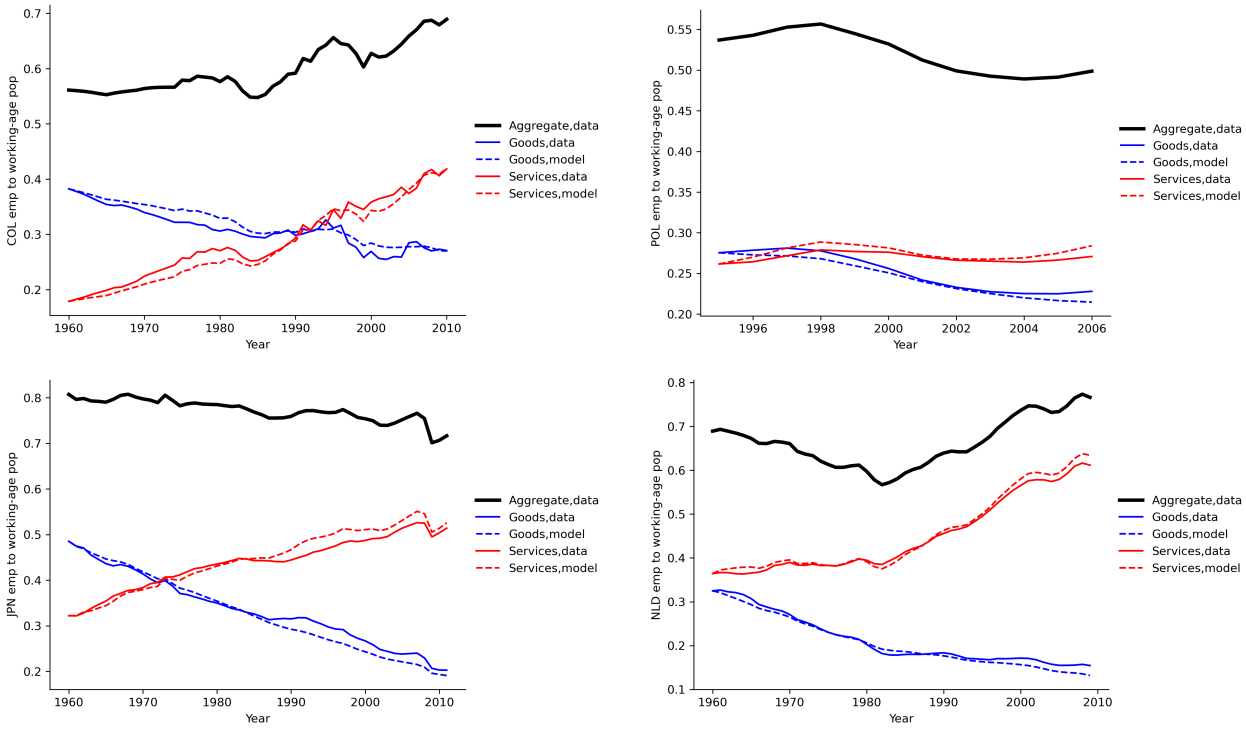
the weak reallocation to services in the data compared to the model.

Figure 9: Services employment ratio across countries, last period



We also document the performance of the model in terms of the reallocation of employment over time for some countries. Figure 10 documents the employment ratios in the model and data for Colombia, Poland, Japan and the Netherlands. We emphasize that the model performs well in accounting for the process of labor reallocation across sectors even in countries with different patterns in the aggregate employment ratio.

Figure 10: Cross-country results–some countries



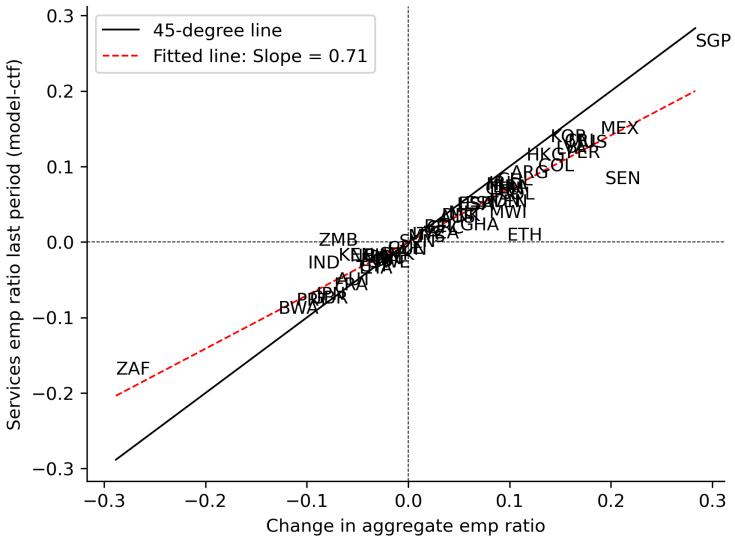
4 The Role of Aggregate Employment

To assess the role of changes in aggregate employment on the rise of services, we preform the following counterfactual experiment. We assume that the aggregate employment ratio is constant to the initial level in all countries ($L_t = L_{\text{initial}}$), and compute the model's implied employment ratios across sectors. Recall the many different country patterns on the aggregate employment ratio are eliminated in the counterfactual and as a result, the difference between the baseline model and the counterfactual represents a measure of the contribution of changes in aggregate employment on sectoral reallocation.

Aggregate employment and services. Our first result is that the calibrated model implies a high elasticity of changes in aggregate employment on services. In particular, we find that changes in aggregate employment account for 70% of the evolution in services. This

result is illustrated in Figure 11 that reports the ratio of changes in aggregate employment against the difference in the employment ratio of services in the model versus the counterfactual. If the change in the employment ratio has no effect on the allocation of employment across sectors, then there would be no difference in the services employment ratio between the model and counterfactual and countries would be alined around the horizontal line. If instead the change in aggregate employment is reflected vis a vis in the difference between the model and counterfactual service employment ratio, the countries would be aligned around the 45 degree line. Our result is that the best fit of the individual country results is a line that represents 70 percent of the variation as illustrated in the dashed red line in Figure 11.

Figure 11: Aggregate employment and services



We can also illustrate this result over time for individual countries. Figure 12 reports the results of the counterfactual aggregate employment for some countries: the United States, France, Chile, Colombia, Mexico, and Korea. The change in the aggregate employment in the United States accounts for two-thirds of rise in services up to 2000, and most of slowdown since then, similar to the result emphasized in Duarte (2020). The decline in the employment ratio in France accounts for slow rise in services. The decrease and then increase in aggregate employment in Chile accounts for the slow rise and then acceleration in

the service employment ratio. The constant aggregate employment and then increase since mid 80s in Colombia and the substantial increases in aggregate employment and services in MEX and KOR are also notable.

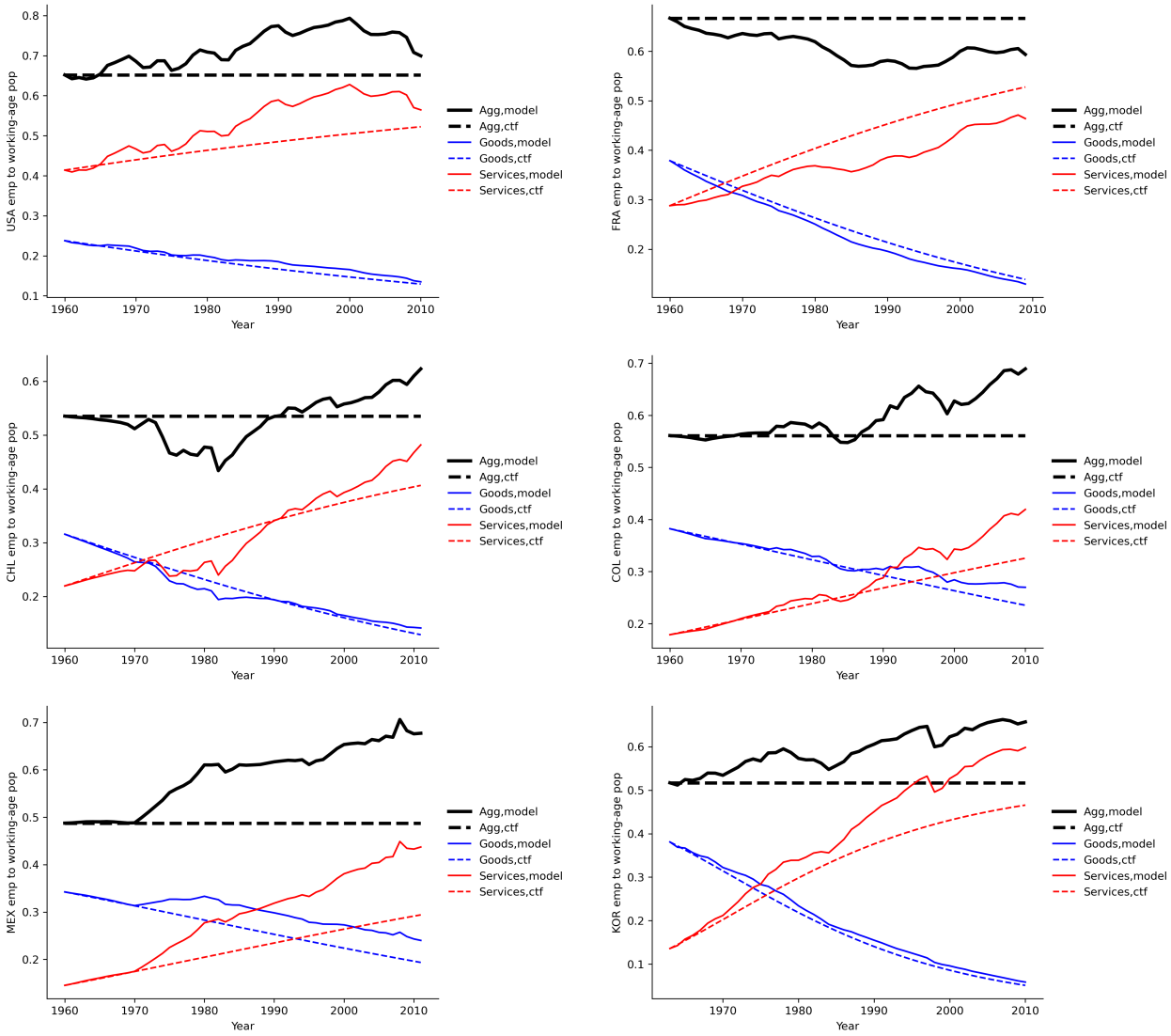
The role of aggregate employment on the rise of services. Our previous result summarizes how much of the change in aggregate employment translates into changes in the employment ratio in services. We now characterize how much the change in services due to changes in aggregate employment account for the observed changes in services employment across countries. We note that characterizing this effect in the cross-country data is difficult because the time series of aggregate employment in many countries is non-monotone. We nevertheless try to provide some summary statistics on the overall contribution. Table 2 reports the average change in the employment ratio between the initial and final period in our sample separately for countries with positive and negative changes.

Table 2: Changes in aggregate employment and the rise of services

	$\Delta(E/P)$	$\Delta(E_s/P)$ due to $\Delta(E/P)$	$\Delta(E_s/P)$
Countries with $\Delta(E/P) > 0$	0.09	0.07	0.21
– Mexico (MEX)	0.19	0.14	0.29
– Singapore (SGP)	0.28	0.26	0.35
Countries with $\Delta(E/P) < 0$	-0.07	-0.05	0.10

In average, the increase in the aggregate employment ratio is 9 percentage points (p.p.) for countries with positive changes and -7 p.p. for countries with negative changes. It then reports the average contribution of the change in employment on services as described, 7 p.p. for countries with positive changes and -5 p.p. for countries with negative changes. As noted previously, the change in services due to changes in aggregate employment is about 70 percent for either set of countries. The last column in Table 2 reports the observed change in the employment ratio in services between the initial and final periods in our sample. Services

Figure 12: Cross-country results–some countries



employment increased 21 p.p. in countries with positive changes in aggregate employment and only 10 p.p. in countries with negative changes. Hence, changes in aggregate employment account for one-third of the rise in services: this is 0.07/0.21 for countries with positive changes in aggregate employment and 0.05/0.15 for countries with negative changes. We note that this one-third contribution is an underestimate due to varying paths of aggregate employment in many countries. To highlight this effect, we report in Table 2 two countries where the aggregate employment ratio rises systematically during the sample period: Mexico and Singapore. For Mexico, the contribution of the change in aggregate employment to services accounts for almost half the actual increase in services (0.14/0.29), whereas for Singapore the contribution is more than eighty percent (0.26/0.35).

Overall, we conclude that changes in the aggregate employment across countries is a substantial driver the rise in services across countries.

5 Conclusion

We document substantial changes in the ratio of employment to working-age population in individual countries over time, changes that are not connected with the level of development and with labor productivity growth. We calibrate a standard model of sectoral reallocation to U.S. data to quantify the role of changes in aggregate employment on the rise of services across countries. The calibrated model implies a high elasticity of changes in aggregate employment on services: a 1 p.p. change in aggregate employment implies a 0.7 p.p. change of employment in services. We find that across countries, changes in aggregate employment account for at least one-third of the rise in services. These results are robust to different specifications of preferences. Our analysis implies that changes in aggregate employment can be a substantial driver of sectoral reallocation to services, especially in countries with low employment ratios.

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