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Services and the Decline of the U.S. Employment-to-Population Ratio

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Abstract

A decline in the employment-to-population ratio since 2000 follows several decades of upward trend. The sharp decline in manufacturing employment that started around 2000 has been proposed as the prime contributor to the decline in overall employment. I show that the key factor in the reversal of trend in the employment ratio is a marked slowdown in the growth of service employment. A standard model of structural transformation is broadly consistent with the changing patterns of sectoral employment in the U.S. economy between 1960 and 2019 and highlights the importance of convergence in labor force participation of women.

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Keywords: employment, manufacturing, services, productivity, structural transformation, labor force, women.

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1 Introduction

Around the year 2000 trends in the U.S. labor market changed markedly. Between 2000 and 2019 the overall annual employment-to-population ratio fell by about 4 percentage points, with a large decline happening before the start of the Great Recession.[1] This decline in the overall employment ratio follows several decades of an upward trend and has been described as a "historic turnaround in U.S. employment trends" (Moffitt, 2012). A large literature has emerged documenting in detail the evidence on U.S. labor market trends and accounting for these trends (Moffitt, 2012; Abraham and Kearney, 2018).

The turn of the century also marks the beginning of a period of sharp contraction in employment in manufacturing. Between 2000 and 2019, the number of manufacturing jobs fell by about 4.4 million, with more than 3 million manufacturing jobs lost between 2000 and 2007. While manufacturing employment had been on a declining trend for a few decades, the magnitude of the contraction that occurred after 2000 is much larger than previous loses. This contraction in manufacturing has been proposed as a prime contributor to the slump in overall employment after 2000 and a large literature has emerged to explain these loses in manufacturing employment (e.g., Acemoglu et al., 2016; Charles et al., 2018).

I document a large deceleration in the growth of service employment since around 2000 and that this deceleration is key in accounting for the slump in employment. Between 1960 and 2000 service jobs increased by about 72 million, making services the key contributor to the observed increase in the aggregate employment ratio over this period. But between 2000 and 2019 service jobs increased by about 23 million, which is about 20 million fewer service jobs compared to the number of service jobs created between 1980 and 2000. In short, the decline in manufacturing jobs after 2000 is dwarfed by the deceleration in service jobs and it is the deceleration in the growth of service employment after 2000 that overwhelmingly

[1] While the overall employment ratio has been increasing since 2010 it has not yet reached its pre-recession level.

accounts for the change in employment trends that occur around this time.

I also document that the key contributor for the increase of the service employment ratio observed before 2000 is an increase in female employment. After 2000, the slowdown in the service employment ratio, occurs for both men and women (it actually declines for men), but it is more pronounced for women than men. Finally, I also document that the slowdown in the service employment ratio after 2000 occurs across disaggregated service categories, but it was most prominent in "Professional and Business Services" and "Trade, Transportation, and Utilities."

The data suggests marked changes in the sectoral allocation of labor associated with large changes in the employment ratio. I build a standard general equilibrium model of structural transformation to study the importance of these changes in overall employment, along with productivity growth, in determining the sectoral allocation of employment and its changes over time. I calibrate the model to the period between 1960 to 2000 and perform experiments for 2000-2019. The calibrated model is broadly consistent with the patterns of structural transformation during the period and it highlights the importance of the evolution of the overall employment ratio for the reallocation of employment to services. In particular, I show that the calibrated model implies that the observed increase in the employment ratio accounts for about 2/3 of the increase in the employment ratio in services that occurred between 1960 and 2000.

Next, I use the calibrated model to derive implications for the period after 2000. I show two main results. First, taking as given the same sectoral productivity growth rates as in the period 1960-2000 and the observed employment ratio since 2000, the model implies sectoral employment ratios that are broadly consistent with the data for the period since 2000. In particular, the model accounts for about 70% of the decline in the manufacturing employment ratio observed between 2000 and 2019. In turn, the model also implies a somewhat more pronounced slowdown in service employment than what is observed in the data. The

employment ratio in services drops from 50.5 percent in 2000 to 49.3 percent in 2019 in the model versus 50.5 percent in the data. Second, the marked change in the behavior of the employment ratio largely accounts for the patterns of structural change since 2000. In particular, the decline in the employment ratio since 2000 largely accounts for the decline in the employment ratio in manufacturing and the stagnation of the employment ratio in services. More importantly, relative to the period between 1960 and 2000, the flattening in the employment ratio, a process strongly associated with the convergence in labor force participation of women, accounts for the bulk of the slowdown in the employment ratio in services. Overall, these results highlight the importance of labor supply changes for sectoral allocation of labor in the United States in the last six decades. Furthermore, a standard model of structural transformation can account for the bulk of the change in the sectoral allocation of labor that occurs around 2000.

This paper relates to a large literature documenting U.S. labor market trends after 2000 (Abraham and Kearney, 2018, provide a comprehensive review). This literature has focused predominantly on accounting for the decline in employment in the manufacturing sector (for instance, Charles et al., 2016, 2018; Fort et al., 2018). Two main views have emerged in this literature. One view emphasizes the role of import competition in the reduction of U.S. manufacturing employment. Autor et al. (2013), for instance, document that growth in imports from China cause higher unemployment, lower labor force participation, and reduced wages in local labor markets where import-competing manufacturing industries command a larger share of initial employment (see also, Autor et al., 2014; Pierce and Schott, 2016). Acemoglu et al. (2016) estimates the role of import competition from China on U.S. manufacturing employment as well as its broader effect on overall U.S. job growth through interindustry linkages. The other view of the literature focuses on how changes in technology (computerization and automation) affects employment. Acemoglu and Restrepo (2019) estimates negative effects of robots on employment and wages across commuting zones and find that these effects are most pronounced in manufacturing. Autor et al. (2015) analyse the si-

multaneous impacts of technology and trade on U.S. employment levels using local level data. My paper contributes to this literature by emphasizing the role of the slowdown in service employment in understanding changes in trends in the U.S. labor market. While the decline in manufacturing employment after 2000 is large relative to the size of manufacturing, it plays a small role in the context of the aggregate labor market. The slowdown in service employment observed after 2000 is a key factor in understanding the reversal of the employment-to-population ratio that occurred around this time. My paper also relates to a literature that studies the forces behind the structural transformation of the economy with development (Rogerson, 2008). I emphasize the role of changes in labor supply in the sectoral allocation of labor, a force of sectoral reallocation that has been overlooked in the literature.

The paper is organized as follows. In the next section, I document a set of facts on sectoral employment changes in the United States since 1960. Section 3 sets up a model of structural transformation to study the forces determining sectoral employment and its changes over time. I conclude in Section 4.

2 A Sectoral Analysis of Employment

I document important facts on the evolution of employment in the United States and its sectoral composition using monthly data from January 1960 to December 2019 from the Current Employment Statistics (CES) survey. I use data on all employees in nonfarm, good-producing and service-providing sectors. To compute employment to population ratios, I use data on civilian non-institutional population 16 years and over from the Current Population Survey (CPS).[2] Changes in demographics affect the employment to population ratio and population aging has contributed to its reduction after 2000 (see, for instance, Abraham

[2]See Appendix A for a description of the data.

and Kearney, 2018). I focus on sectoral differences in employment ratios and demographic changes play a minimal role in this analysis. The facts reported carry through to employment ratios computed using working-age population instead of population 16 years and over.

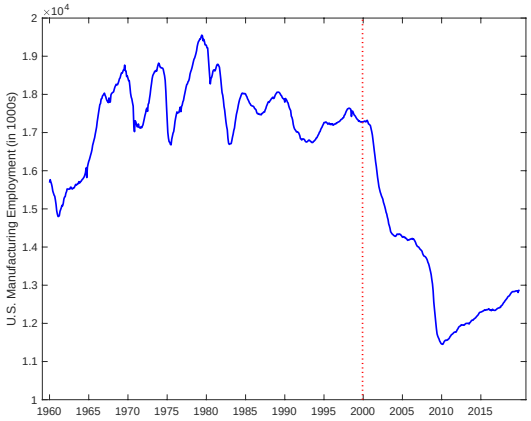
From 1960 to 2000 the employment to population ratio displayed an upward trend, from 46.3 percent in 1960 to 62.1 percent in 2000.[3] Around 2000 trends in the U.S. labor market changed markedly. Between 2000 and 2007, just before the Great Recession began, the employment to population ratio declined by 2.6 percentage points. It declined a further 4.7 percentage points during the Great Recession, reaching 54.8 percent in 2010. The employment to population ratio has been increasing since 2010 and it averaged 58.4 percent in 2019.

The change in trend in the employment ratio around 2000 coincides with the beginning of a sharp decline in manufacturing employment (see Figure 1a). Manufacturing employment has declined since around 1980 but the pace of decline accelerated markedly around 2000. Between 1980 and 2000 manufacturing jobs fell by about 1.5 million but during the much shorter period from 2000 to 2007 manufacturing jobs declined by about 3.5 million. This number represents a staggering 26 percent decline relative to the level of manufacturing employment in 2000. This contraction in manufacturing has been proposed as a prime contributor for the concurrent decline in the overall employment ratio, for instance, Acemoglu et al. (2016) and Charles et al. (2018). Manufacturing jobs declined even further with the Great Recession and while they have since started to increase, their level in 2019 was still 4.4 million jobs below the level in 2000.

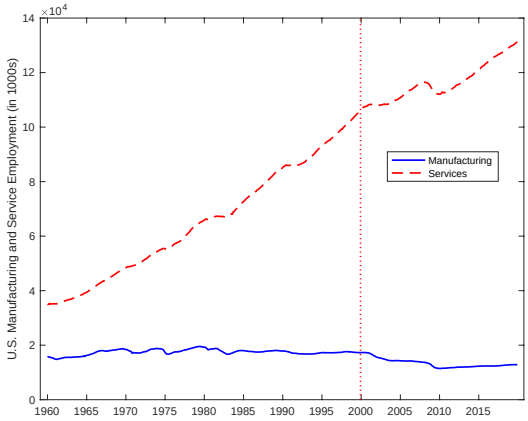
Figure 1b puts the evolution of manufacturing employment into the broader context of the U.S. labor market by plotting employment in both the manufacturing and service sectors over the period. In the broader context of the U.S. labor market, the decline in manufacturing

[3] I report employment ratios computed with CES employment data and CPS population data. The numbers reported differ from measures of the employment ratio computed using alternative series. Throughout the paper I report year averages, unless otherwise noted.

Figure 1: U.S. Monthly Employment



(a) Manufacturing



(b) Manufacturing and Services

employment after 2000 is much less dramatic. Instead, Figure 1b illustrates the sustained increase in service employment over the entire period. Between 1960 and 2000 the U.S. economy added about 72 million jobs in the service sector. After 2000, employment in services continues to grow but at a noticeably slower pace than before.

To characterize changes in employment trends more effectively, I focus on changes over two-decade periods from 1960 to 2019. Table 1, Panel A, reports changes in nonfarm, manufacturing, other goods, and service employment. I also report numbers for the period 2000-2007 in all tables to highlight the change in trend after 2000 and to avoid confusing this trend with the effect of the Great Recession. Over the periods 1960-1980 and 1980-2000 nonfarm employment grew by about 40 million jobs. Compared to these two periods, total employment grew considerably less between 2000-2019, by about half or 19 million jobs. Loses in manufacturing jobs started prior to 2000 but the period after 2000 is characterized by a much sharper decline in manufacturing employment. In contrast, employment in services has grown substantially over the 3 periods reported. However, note that after 2000 employment in services grew substantially less than in the previous two periods, from an

Table 1: Changes in Employment Levels and Ratios

Panel A				
	1960-1980	1980-2000	2000-2019	2000-2007
Changes in Employment Levels				
Nonfarm	+36,240	+41,500	+19,380	+5,960
Manufacturing	+3,300	−1,470	−4,420	−3,390
Other Goods	+1,790	+1,860	+860	+960
Services	+31,150	+41,110	+22,940	+8,390
Panel B				
	1960-1980	1980-2000	2000-2019	2000-2007
Changes in Employment Ratios				
Nonfarm	+7.66	+8.14	−3.69	−2.60
Manufacturing	−2.00	−3.05	−3.17	−2.14
Other Goods	+0.10	+0.18	−0.29	+0.13
Services	+9.56	+11.01	−0.23	−0.59

Notes: Employment Levels are in thousands; Employment Ratios refers to employment-to-population ratios and are in percentage points. The goods-producing sector is disaggregated into "manufacturing" and "other goods". Nonfarm is disaggregated into goods and services.

average of about an additional 35 million service jobs during 1960-1980 and 1980-2000, to around an additional 23 million service jobs during 2000-2019. That is, in terms of absolute number of jobs, the decline in manufacturing jobs after 2000 is dwarfed by the deceleration in service jobs. Note that these changes in employment trends occur around 2000 and well before the onset of the Great Recession as they are already present in the period 2000-2007.

How do these changes in employment translate into a sectoral decomposition of the employment-to-population ratio? Panel B in Table 1 reports changes in the overall employment ratio as well as changes in the ratios of sectoral employment to population over the same two-decade periods. The change in total nonfarm employment ratio is simply the sum of changes in employment ratios for all sectors of the economy,

$$\Delta\left(\frac{E_t}{P_t}\right) = \sum_i \Delta\left(\frac{E_t^i}{P_t}\right),$$

where E^i denotes employment in sector i and P denotes population. Thus the change in a sector's employment ratio can be interpreted as the sector's contribution in accounting for the change in the total employment ratio. For instance, between 1960 and 1980 the employment ratio increased by 7.66 percentage points while the manufacturing employment ratio fell by 2.00 percentage points. That is, between 1960 and 1980, employment in manufacturing grew less than population and the overall employment to population ratio would have declined by 2 percentage points if employment ratios in all other sectors of the economy had remained constant.

Note that the contribution of changes in the manufacturing employment ratio for changes in the total employment ratio is negative for all periods reported in Table 1, between 2 and 3 percentage points. In fact, the large decline in manufacturing employment after 2000 translates into a contribution to the change in the aggregate employment ratio that is commensurate with losses in manufacturing in previous periods. To see why this is the case, note that the change in a sectoral employment ratio between years $t-1$ and t is given by

$$\Delta\left(\frac{E_t^i}{P_t}\right) = \frac{E_{t-1}^i}{P_t}\left[\frac{\Delta E_t^i}{E_{t-1}^i} - \frac{\Delta P_t}{P_{t-1}}\right],$$

the difference between the growth rate of sectoral employment and total population over the period, weighted by initial sectoral employment relative to end-of-period population. While for manufacturing the term in brackets becomes substantially more negative over the 3 periods considered, the weight E_{t-1}^i/P_t is small and declining, dampening the effect of the large decline in manufacturing employment between 2000 and 2019 on the overall employment ratio.

In contrast to manufacturing, up to 2000, the employment ratio in services increased by about 10 percentage points in each two-decade period. That is, between 1960 and 2000, growth in service employment is the key contributor to the increase in the overall employment to population ratio between 1960 and 2000. After 2000, however, the contribution of changes

in the service employment ratio falls to about zero. While the decline in the manufacturing employment ratio during 2000-2019 accounts for about 85 percent of the decline in the overall employment ratio over this period, it is clear that it is the slowdown in service employment that plays a crucial role in the reversal of trend in the U.S. labor market around 2000. That is, the slowdown in service employment that occurs after 2000 is a key driver in understanding changes in the overall employment-to-population ratio.

A More Detailed Look into Services. Table 2 provides more detailed evidence on changes in employment. Panel A reports changes in sectoral employment ratios by gender. For ease of exposition I report changes for "Goods" and do not distinguish between "Manufacturing" and "Other Goods." CES employment data by gender is available only after 1964 and thus the first period reported in panel A of Table 2 is 1964-1980.

The increase in the ratio of nonfarm employment to population up to 2000 is accounted for mostly by increases in the employment-to-population ratio of women, with minimal contribution from changes in the employment ratio of men. In fact, during this period there is "a grand gender convergence" (Goldin, 2014), a substantial convergence of the employment ratio of women to that of men: in 1964 the difference between the employment ratios of men and women is 17 percentage points, by 2000 this difference is reduced to 3 percentage points and remains about constant thereafter.[4] The decline in the nonfarm employment ratio observed between 2000 and 2019 is accompanied by declines for both men and women, with a larger decline for men. However, while the decline in male employment accounts for more than 80 percent (3.00/3.69) of the decline in the nonfarm employment ratio between 2000 and 2019, the slowdown in female employment accounts for more than 65 percent ((7.28+0.69)/(8.14+3.69)) of the change in trend between 1980-2000 and 2000-2019. That is, changes in the employment ratio of women account for the bulk of changes in the aggregate employment ratio over the entire period from 1964 to 2019.

[4] Fukui et al. (2018) document this fact and study its role in the slowdown of overall employment during recent business cycle recoveries.

Table 2: Changes in Employment Ratios – Gender & Service Industries

Panel A				
	1964-1980	1980-2000	2000-2019	2000-2007
Changes in Employment Ratios				
Nonfarm				
Total	+7.06	+8.14	−3.69	−2.60
Women	+7.61	+7.28	−0.69	−0.88
Men	−0.55	+0.86	−3.00	−1.72
Goods				
Total	−1.39	−2.87	−3.46	−2.01
Women	+0.31	−0.77	−1.14	−0.79
Men	−1.70	−2.10	−2.32	−1.22
Services				
Total	+8.45	+11.01	−0.23	−0.59
Women	+7.30	+8.05	+0.46	−0.09
Men	+1.15	+2.96	−0.69	−0.50
Panel B				
	1960-1980	1980-2000	2000-2019	2000-2007
Changes in Employment Ratios				
Services	+9.56	+11.01	−0.23	−0.59
Trade, Transportation & Util.	+1.47	+1.36	−1.58	−0.86
Information	−0.07	+0.30	−0.62	−0.40
Financial Activities	+0.84	+0.67	−0.32	−0.06
Professional & Business Serv.	+1.35	+3.35	+0.42	−0.10
Education & Health	+1.71	+2.96	+2.19	+0.88
Leisure & Hospitality	+1.05	+1.57	+0.88	+0.21
Other Services	+0.66	+0.79	−0.14	−0.06
Government	+2.54	+0.02	−1.07	−0.20

Notes: Employment Ratios are in percentage points. Employment ratios by gender are computed as employment by gender relative to total population.

In the goods sector, employment ratios decreased over all periods for both women and men (with the exception of women in the first period reported, 1964-1980). Nevertheless, the losses in the employment ratios of men in goods always exceeds those of women in all time periods. In the service sector, employment ratios of both men and women rose prior to 2000 but the rise in female employment in services accounts for most of the increase in the service employment ratio before 2000. This finding is consistent with the fact that the share of female employment in services is very high. After 2000, there is a slowdown in service employment for both men and women. This slowdown is particularly marked for women and the change in the trend in the service employment ratio around 2000 is accounted for mostly by the behavior of the employment ratio of women.

In Panel B of Table 2, I report changes in employment ratios for eight service industries that aggregate to total services. Prior to 2000, employment in all service industries grew faster than population, implying positive changes in employment ratios for all service industries (except for "Information" between 1960 and 1980). Over the period 1960-1980, employment grew the fastest in "Government," accounting for about 26 percent of the increase in the service employment ratio over this period, followed by "Education & Health," "Trade, Transportation & Utilities," and "Professional & Business Services." These four industries account for more than 70 percent of the increase in the employment ratio in services over this period (about 7 percentage points). Between 1980 and 2000, the contribution of changes in employment in "Government" drops to about zero and the increase in the service employment ratio over this period is accounted for by the increase in employment in private services. The service industries with larger employment increases were "Professional & Business Services" and "Education & Health," which account for about 57 percent of the increase in the employment ratio in services between 1980 and 2000, about 6.3 percentage points.

After 2000, there is a marked slowdown in employment across all service industries. This slowdown was most prominent in "Professional & Business Services" and "Trade, Trans-

portation & Utilities," with the slowdown in these two industries accounting for about 50 percent of the drop in the change of the aggregate service employment ratio between 1980-2000 and 2000-2019.

To summarize, after 2000, growth in the service employment ratio came to a halt while the manufacturing employment ratio continued to decline at about the same rate as before. These facts imply that the pattern of sectoral reallocation of employment changed dramatically around 2000. In the next section I set up a standard model of structural transformation to interpret these facts and assess potential sources of observed changes.

3 The Model

I develop a standard general equilibrium model of the structural transformation of an economy, following Rogerson (2008) and Duarte and Restuccia (2010), to study the change in the pattern of sectoral reallocation that occurred around 2000. The model economy comprises two sectors (goods and services) and labor reallocation across sectors is driven by two forces – an income effect due to non-homothetic preferences and a substitution effect due to differential sectoral productivity growth. Motivated by the data, I also allow for movements in the overall employment ratio. I calibrate a benchmark economy to U.S. data for the period 1960 and 2000 and show that this basic framework captures the salient features of changes in sectoral labor allocations that occur between 2000 and 2019.

3.1 The Environment

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.[5]

I assume that there is 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.

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 household has preferences over consumption of goods and services as follows:

$$\sum_{t=0}^{\infty} \beta^t u(c_{g,t}, c_{s,t}), \quad \beta \in (0,1).$$

The per-period utility is given by:

$$u(c_{g,t}, c_{s,t}) = \left(a\left(c_{g,t} - \bar{g}\right)^{\epsilon} + (1-a)\left(c_{s,t}\right)^{\epsilon}\right)^{\frac{1}{\epsilon}},$$

where $\bar{g} > 0$ is a subsistence consumption level of goods, $a \in (0,1)$, and $\epsilon < 1$. For $\bar{g} > 0$, these preferences imply that the income elasticity of goods is smaller than one. The household chooses consumption allocations to maximize utility subject to the budget constraint

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

[5] I abstract from capital for simplicity and due to data limitations. In this model, differences in labor productivity may also reflect differences due to capital.

taking prices and the wage rate as given.

Equilibrium. This model is a sequence of static labor 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 imply that the marginal rate of substitution between goods and services equals their relative price. Combining this condition with market clearing conditions and the firms' first-order conditions implies that employment in the service sector is given by

$$L_s = \frac{\chi}{1+\chi}\left(L - \frac{\bar{g}}{A_g}\right),$$

where $\chi = \left(\frac{a}{1-a}\right)^{\frac{1}{\epsilon-1}} \left(\frac{A_g}{A_s}\right)^{\frac{\epsilon}{\epsilon-1}}$. This model incorporates two channels that generate sectoral labor reallocation associated with structural transformation: income effects due to non-homothetic preferences and substitution effects due to differential productivity growth across sectors.[6]

3.2 Calibration

I calibrate the benchmark economy to be consistent with the process of structural transformation in the United States between 1960 and 2000. The model is driven by exogenous sectoral productivity growth and changes in the employment ratio. In particular, I assume

[6]For models of structural transformation emphasizing income effects, see, Echevarria (1997) and Kongsamut et al. (2001). For models of structural transformation emphasizing substitution effects, see, Ngai and Pissarides (2007).

that productivity grows at an exogenous and constant rate in each sector, that is,

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

I also assume that the employment ratio L_t changes in each period according to the data. Note that L in the model maps to the nonfarm employment-to-population ratio in the data.

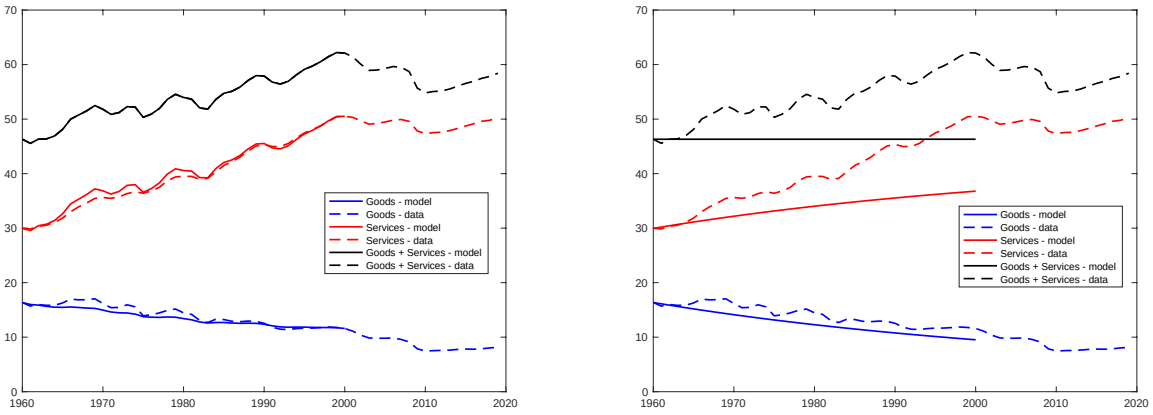
Sectoral initial productivities, $A_{i,60}$, $i \in \{g, s\}$, are set to unity in 1960 and the average annual sectoral growth rates of labor productivity are taken from Rogerson (2008) and set equal to 2.48 percent and 1.44 percent in the goods and service sector, respectively. The non-farm employment ratio determines the value of L_t in each period. The preference parameter ϵ is set to -1.5, as in Duarte and Restuccia (2010). Given this value, the parameters a and $\bar{g}$ are set so that the model matches the share of employment in the goods sector in 1960 and 2000.

Performance. Figure 2a reports the employment ratios in goods and services implied by the model (solid lines) and in the data (dashed lines). The figure also reports the total non-farm employment ratio. The calibration is designed so that the model matches sectoral employment ratios on 1960 and 2000. Nevertheless, note that the model does a good job capturing year-by-year changes in these sectoral ratios even with constant growth rates of sectoral productivity.

Role of Driving Forces. I disentangle the role of sectoral productivity growth and the role of changes in the employment ratio in accounting for the observed variation in sectoral employment by computing the equilibrium of the model economy assuming a counterfactual constant employment ratio since 1960. Figure 2b reports the employment ratios in goods and services implied by the model when the overall employment ratio remains constant at its 1960-level.

The results are striking. The calibrated model implies that the increase in the employment

Figure 2: Employment Ratios across Sectors 1960 – 2000



(a) Observed L_t (b) Constant L_t at 1960 level

ratio has a substantial effect on the growth of service employment, while at the same time a modest quantitative effect on the reallocation of labor out of the goods sector. The employment ratio in the goods sector declined by 4.8 percentage points in the data, from 16.4 percent in 1960 to 11.6 percent in 2000, while in the model with a constant overall employment ratio, the employment ratio in the goods sector drops to 9.5 percent in 2000, a 6.9 percentage point decline. For services the difference is dramatic; the employment ratio in services increases by 20.5 percentage points in the data, from 30 percent in 1960 to 50.5 percent in 2000, whereas in the model with a constant employment ratio, the employment ratio in services increases only to 36.8 percent in 2000, a 6.8 percentage point increase. This implies that about 2/3 of the observed increase in the employment ratio in services is due to the increase in the overall employment ratio.

To see why the model implies that increases in the employment ratio affect the service sector disproportionately more than the goods sector, note that the change in the employment ratio in services is given by

$$\frac{\partial L_s}{\partial L} = \frac{\chi}{1+\chi},$$

where, as before, $\chi = \left(\frac{a}{1-a}\right)^{\frac{1}{\epsilon-1}} \left(\frac{A_g}{A_s}\right)^{\frac{\epsilon}{\epsilon-1}}$. The magnitude of the sectoral effect of changes in L depends on the relative weight of goods and services in utility $(a/(1-a))$, relative sectoral productivity (A_g/A_s), and the parameter ϵ. For $\epsilon = -1.5$, the low weight of goods in the utility function implied by the calibration means that the term $(a/(1-a))^{\frac{1}{\epsilon-1}}$ is about 5; that is employment in services increases by about 0.83 in response to a marginal increase in L (when labor productivity is equal across sectors). In addition, note that, as long as $\epsilon < 0$, the term $(A_g/A_s)^{\frac{\epsilon}{\epsilon-1}}$ grows over time since labor productivity tends to grow faster in the goods sector than the service sector. This additional effect further magnifies, over time, the effect of a given increase in L on service employment relative to goods employment.

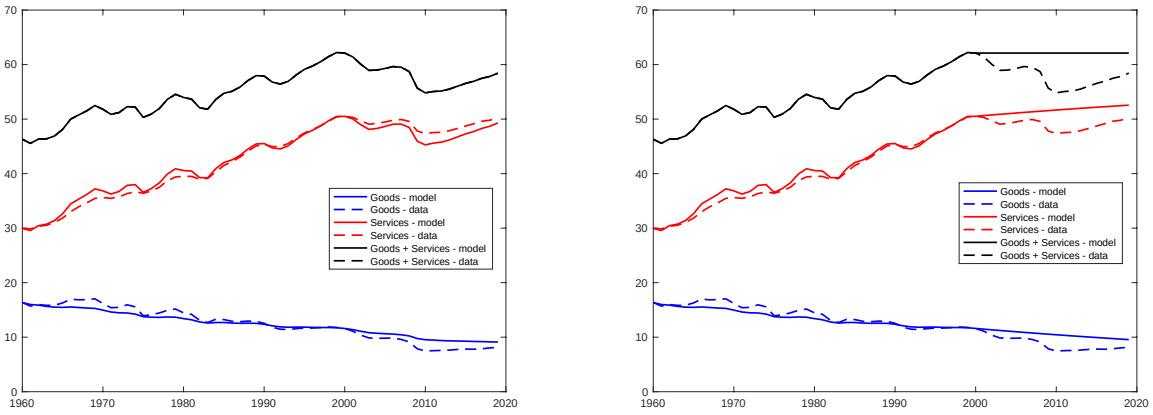
The rise in the employment ratio, strongly associated with the rise in women's labor force participation, is key in the context of this model to capture the strong rise in services.[7] This highlights the importance of labor supply changes in the overall process of structural change in the U.S. economy, a feature that is often abstracted from in quantitative models of structural transformation.

3.3 Implications since 2000

I now turn to the implications of the model economy for employment changes after 2000. As before, I keep the same constant annual growth rates of sectoral labor productivity γ_g and γ_s and I take the observed employment ratio in the data as given. Figure 3 reports the employment ratios in goods and services implied by the model. For the period after 2000, the model implications are broadly consistent with the data. In the model, employment in the goods sector continues to decline after 2000, from 11.6 percent in 2000 to 9.1 percent in 2019 versus 8.1 percent in the data. In turn, the model also implies a somewhat more pronounced slowdown in service employment than what is observed in the data. The employment ratio

[7] Ngai and Petrongolo (2017) study the role of the rise in services in accounting for the evolution of hours and wages by gender between 1970 and 2006.

Figure 3: Model Implications



(a) Observed L_t (b) Constant L_t after 2000

in services drop from 50.5 percent in 2000 to 49.3 percent in 2019 in the model versus 50.3 in the data.[8]

The Role of the Employment Ratio. The literature has focused on the apparent secular decline in the employment ratio since 2000. Note that the overall employment ratio declines from 62.1 percent in 2000 to 58.4 percent in 2019. I evaluate the importance of this decline in the employment ratio for the slowdown in the employment ratio in services by considering the counterfactual scenario in which the overall employment ratio does not decline after 2000 and instead remains constant at the 2000 level. Figure 3b reports the employment ratios in the model in this counterfactual scenario along with the employment ratios in the data.

With a constant employment ratio since 2000 the model still implies a reallocation of employment from goods to services. For instance, the model would imply an increase in the

[8]There is evidence of a marked increase in the growth of manufacturing labor productivity between 2000 and 2007. In the context of this model, faster productivity growth in goods contributes to a further decline in the employment ratio in the goods sector and a smaller decline in the service sector, bringing the model closer to data. Computing the equilibrium of the model with the same assumptions as before and a higher growth rate of labor productivity in goods after 2000 of 3.5 percent (instead of 2.48 percent in the benchmark economy) implies that the employment ratio in the goods sector drops to 8.1 percent in 2019 and the employment ratio in services rises to 50.3 percent.

employment ratio in services from 50.5 percent in 2000 to 52.5 percent in 2019, and a decline from 11.6 percent in 2000 to 9.6 percent in 2019 in the goods sector. These results imply that the complete stagnation in the employment ratio in services and the entire decline in manufacturing are accounted for by the behavior of the overall employment ratio during this period. Similarly, note that just a flattening of the employment ratio since 2000 is able to account for the bulk of the slowdown in the employment ratio in services in this period compared to the previous decades since 1960. This suggests that the substantial increase in the overall employment ratio since 1960 and flattening out since 2000—a process strongly associated with the convergence in labor force participation of women—accounts for a substantial portion of the marked slowdown in the employment ratio in services documented earlier.

4 Conclusion

The change in trend in the U.S. labor market that occurred around 2000 is associated with a sharp deceleration in the growth of employment in services. The decline in manufacturing employment that occurred after 2000, which has been the focus of most of the literature, is large relative to the size of the manufacturing sector, but relatively small in terms of its contribution to changes in the overall employment ratio. Instead, it is the slowdown in service employment after 2000 that overwhelmingly accounts for the decline in the employment ratio.

I study the sectoral allocation of labor in an otherwise standard model of structural transformation driven by sectoral productivity growth rates and changes in the aggregate employment ratio. I calibrate the model to U.S. data between 1960 and 2000, and show that the model implies sectoral labor allocations after 2000 that are broadly in line with the data. The model implies that a flattening of the employment ratio after 2000, as opposed to the observed decline, accounts for the bulk of the observed slowdown in the employment ratio in

services. The model suggests that the process of convergence in the labor force participation of women observed up to around 2000, which plays an important role in the behavior of the employment ratio, accounts for the bulk of change in the sectoral allocation of labor that occurred around 2000.

This paper highlights the role of services in accounting for the "historic turnaround in U.S. employment trends" around 2000. Moreover, the analysis suggests that the convergence in labor force participation of women plays an important role in this process. However, I note that the slowdown in service employment after 2000 occurred for both men and women and that it does not appear to have been more pronounced in service industries with a larger share of female employment. Therefore, other mechanisms appear to be at play. It is important to understand the relative importance of supply versus demand factors in accounting for the slowdown in service employment. And it is also important to explore the role of higher import competition and automation in the service sector. A slowing down of employment growth does not have the costs associated with job losses. Nevertheless, given its importance in the U.S. labor market, further understanding of the slowdown in service employment is key in understanding aggregate labor market trends.

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A Data Sources

I use data from the Current Employment Statistics (CES) survey on total and women employees. Data are monthly and seasonally adjusted. Series on total employment are available since January 1939 while series on women employees are available since January 1964. I use the following series: nonfarm, goods-producing, and service-providing. I disaggregate the goods-producing sector into "manufacturing" and "other goods," which comprises "construction" and "mining and logging". I disaggregate the service-providing sector into the following industries: "trade, transportation, and utilities", "information," "financial activities," "professional and business services," "education and health," "leisure and hospitality," "other services," and "government."

I use data from the Current Population Survey (CPS) on population levels (total, men, and women). Data are monthly and seasonally adjusted, available since January 1948. Data cover civilian non-institutional population, 16 years and over. I obtain working-age population by subtracting civilian non-institutional population 65 years and over from population 16 years and over.