Review of Economic Dynamics 24 (2017) 95–131

Contents lists available at ScienceDirect

Review of Economic Dynamics

www.elsevier.com/locate/red

Determinants of structural change ☆

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ARTICLE INFO

Article history:
Received 27 September 2014
Received in revised form 24 January 2017
Available online 30 January 2017

JEL classification:
O11
O47

Keywords:
Structural change
Structural transformation
Nonhomothetic preferences
Sectoral productivity

ABSTRACT

In this paper I ask which of the multiple mechanisms suggested in the literature are quantitatively important for understanding the process of structural change. I build a model combining four forces in a common framework: (i) sector-biased technological progress, (ii) nonhomothetic tastes, (iii) international trade and (iv) changing wedges between factor costs across sectors. I calibrate the model using the data for 45 diverse countries over the period 1970–2005 and use counterfactual simulations of the model to systematically assess the relative importance of the four determinants of structural change. I find that sector-biased technological change is overall the most important mechanism and it is essential for understanding the decline of manufacturing labor share and the corresponding growth in services in developed countries. Nonhomothetic preferences are key to accounting for movement of labor out of agriculture, which matters primarily for poorer countries. International trade and changes in relative factor costs across sectors are important for individual countries but their impact on the relocation of labor is less systematic. I also show that a model with homothetic preferences would overstate the importance of agriculture in accounting for differences in aggregate productivity across countries and over time.

1. Introduction

Structural change is one of the most robust features of economic development. As countries grow richer, we observe secular shifts in their allocation of labor and expenditure across broad sectors of agriculture, manufacturing and services. A number of theoretical explanations of this process have been proposed in the literature.[1] There is little consensus, however, on the relative importance of the suggested mechanisms. The goal of this paper is to assess, quantitatively, how crucial are various forces for understanding the observed patterns of structural change.

To address this issue, I begin by building in Section 2 a quantitative model combining in a unified framework four mechanisms that can drive structural change. The first classic source of structural change is sector-biased technological progress. If productivity growth in a sector is slow relative to other sectors then the relative price of the sluggish sector increases over time. With sectoral outputs being gross complements in consumption, expenditures and labor shift towards sectors with relatively slow productivity growth. The second classic explanation of structural change is based on nonhomothetic preferences. As incomes rise, households spend relatively less on agricultural goods and more on services.

☆ I am grateful to Gene Grossman, Steve Redding and Esteban Rossi-Hansberg for their encouragement and guidance. I also thank the editors Diego Restuccia and Matthias Doepke, two anonymous referees, as well as Ariel Burstein, Pablo Fajgelbaum, Richard Rogerson and seminar participants at UCLA, CEA 2014 and SED 2014 for helpful comments and suggestions.

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[1] See Herrendorf et al. (2013a) for an overview of the large theoretical and empirical literature on structural transformation.

http://dx.doi.org/10.1016/j.red.2017.01.007
1094-2025/

To allow both sector-biased technological change and income effects to operate, I use a flexible specification of consumer preferences. The augmented constant differences of elasticities of substitution (ACDES) preferences that I introduce to the structural change literature nest other commonly used preference specifications. The extra flexibility helps me to better asses the importance of sector-biased productivity growth and of the overall rise in aggregate productivity (income effect) for structural change in a broad sample of countries.[2]

International trade is the third channel affecting the sectoral composition of economies. Matsuyama (2009) formalizes an argument that the same underlying forces can have quite different implications for structural change in a closed economy and in an interdependent world. For example, whereas fast productivity growth in manufacturing would lead to a decline in the manufacturing labor share in a closed economy, in an open economy manufacturing employment can expand because of specialization according to comparative advantage. This consideration is potentially important given that in recent decades many countries have become substantially integrated with the world economy. I therefore embed my framework in a three-sector general equilibrium model of international trade. I treat agriculture and manufacturing as tradable sectors as in the Ricardian model of Eaton and Kortum (2002) while services are treated as nontradable. In order to better capture the impact of openness on sectoral labor shares, I allow for trade imbalances both at the sectoral and at the aggregate level.

The last force influencing structural change is represented by changes in relative labor costs across sectors. It is well known that the breakdown of economic activity at a level of broad sectors looks different when measured in nominal terms (expenditure and value added shares) than in terms of factor allocation (labor shares). Buera and Kaboski (2009) observe that quantitative models therefore need to allow for factor cost differences across sectors in order to be consistent with both nominal and real margins of structural change. In my model, as in most quantitative work on structural change, homogeneous labor is the only primary factor of production. Factor cost differentials are therefore summarized by intersectoral labor wedges. An open empirical question is the extent to which changes in wedges over time can account for the relocation of real resources across sectors.

To assess the empirical relevance of the four channels described above, I take the model to the data for 45 countries over the period 1970–2005. I combine data from multiple sources to construct an unbalanced panel featuring countries with diverse levels of economic development. Working with a diverse sample offers two main advantages relative to the prior literature studying the experiences of individual countries. First, it puts more discipline on the calibration of key unknown model parameters. Second, it allows me to systematically assess how the relative importance of different forces behind structural change depends on the country's stage of economic development and other country characteristics, such as the degree of openness to trade or country size.

My baseline calibration, described in Section 3, is designed so that the model exactly accounts for structural change in all countries along two key margins: sectoral shares of employment and value added. I use the general equilibrium predictions of the model for the third margin – sectoral labor productivity growth – to obtain the parameters of ACDES preferences via a GMM procedure.

In Section 4 I use counterfactual simulations of the calibrated model to assess the importance of each of the model's four forces. The counterfactual simulations switch individual channels on and off in order to isolate their impact on structural change. To quantify that impact I introduce the Labor Relocation Index which measures the fraction of the observed labor relocation across sectors that can be accounted for by a specified combination of forces.

I find that the sector-biased technological progress is overall the most important factor. For example, this channel alone can explain 43% of the labor relocation for the median country. At a more disaggregated level, the sector-biased technological progress is particularly important for explaining the net movement of labor from manufacturing to services and is thus crucial for understanding structural change occurring in developed countries. While income effects have on average less power to account for broad shifts in sectoral employment, they remain an important force. In particular, nonhomotheticity of preferences plays a key role in generating the transition of labor out of agriculture and is thus very relevant for countries at earlier stages of economic development. My quantitative exercise therefore shows that the relative importance of the two classic channels depends on how far along a country is in the process of structural change. Both mechanisms are necessary to provide a fully satisfactory account of a complete transition from an agriculture-based to a service-based economy.

International trade and changes in intersectoral wedges play a more idiosyncratic role in accounting for labor relocation. Ignoring either channel would not lead to a systematic bias in predicting the changes in labor allocation over time. Both forces do nevertheless play a significant idiosyncratic role for some countries. For example, trade is relatively important for smaller countries that tend to rely on it more. Moreover, there are strong interactions between trade and wedges in that the latter only matter in an open economy setting.

In Section 5 I investigate the importance of nonhomothetic preferences for modeling structural change from a different perspective. I recalibrate the model restricting preferences to be of the homothetic CES form. I then compare the sectoral productivity patterns derived from the homothetic and the baseline model. Because both models need to match the same expenditure share data, the homothetic model requires larger dispersion of relative prices in the cross section of countries and larger changes in relative prices within countries over time. The CES model achieves this by predicting larger dispersion

[2] As explained by Herrendorf et al. (2013b), the relative importance of the two channels might depend on how one defines the commodity space. In their terminology, I use a consumption value added approach so that, e.g., the expenditure share of agriculture reflects the share of value added originating in agriculture in total final expenditure.