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Regional Development Under Socialism: Evidence From Yugoslavia

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Abstract

This paper analyses the patterns of regional growth and development in Yugoslavia, under the most decentralised socialist system that ever existed. My analysis reveals that despite government efforts to the contrary, socialist economic development in Yugoslavia resulted in divergence rather than in convergence between the constituent regions. I find that regional income divergence was caused by the failure of the less developed regions to converge towards the employment rates and total factor productivities of the more developed regions. I interpret these failures as symptoms of a single underlying problem: a capital intensity bias inherent to the governing objective of labour-managed firms. Socialist Yugoslavia moved from having one central plan, to having many mutually competitive plans. While on aggregate this may have created a net positive productivity outcome compared to other socialist economies, it created unique distortions. The decentralisation policies were implemented with the aim of enhancing regional cohesion and social stability. They led, however, to exactly opposite outcomes.

Keywords: Economic Growth; Regional Development; Economic History: Yugoslavia; Socialism

JEL Classification Numbers: E02; N14; O47; P27

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1 Introduction

Policy makers must pay attention to regional inequality because of its impact on welfare. Regional inequality contributes to overall inequality. It can undermine social cohesion and infuse political tensions (see e.g. in Belgium, Italy and Spain). This seems particularly likely in countries where labour is immobile, and where regional distribution of income coincides with the spatial distribution of ethnic groups. This was the case in socialist Yugoslavia. The country was extremely heterogeneous. It was divided into six *Republics* (Bosnia-Herzegovina, Croatia, Macedonia, Montenegro, Slovenia and Serbia) and two *Autonomous Provinces* that were part of Serbia (Kosovo and Vojvodina). These regions were divided along many lines. Yugoslavs were fond of describing their country as one with two alphabets, three religions, four languages, and five nations.

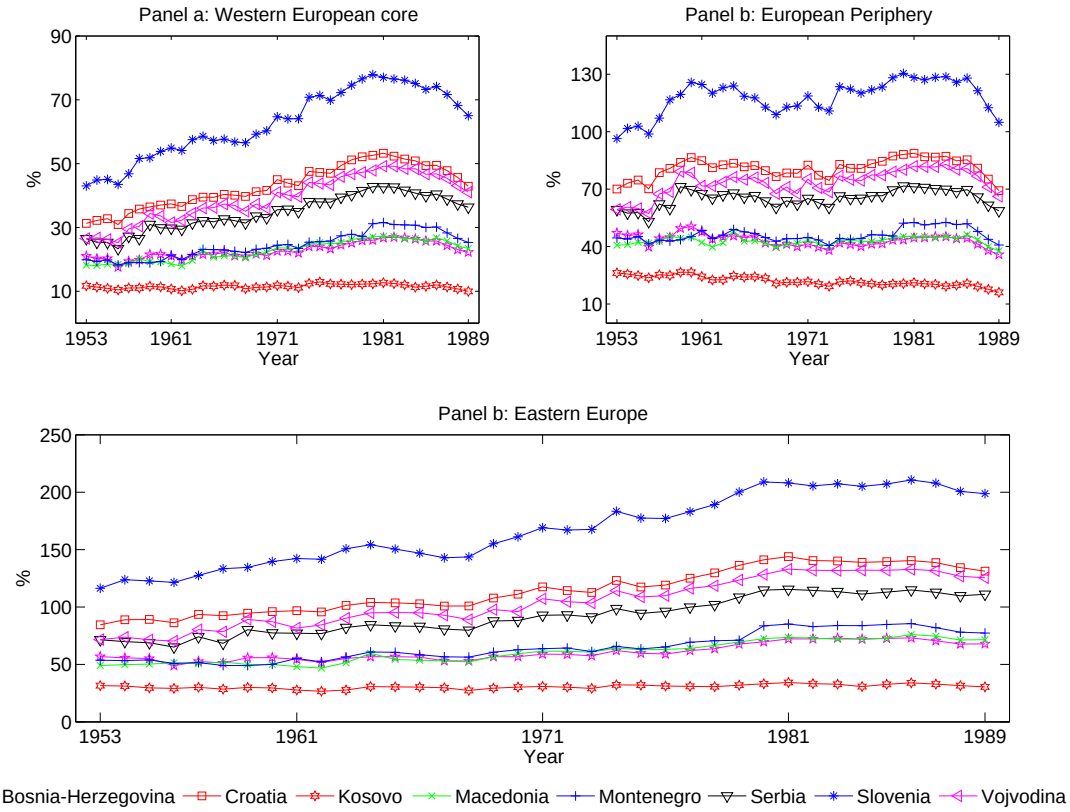
Reduction of regional inequality was a major priority of Yugoslav authorities (Bičanić, 1973; Pleština, 1992). In order to foster convergence in regional economic development and to preserve social stability, Yugoslav government 1) devolved power to its constituent Republics, 2) transferred control over prices, output, and enterprise budgets to labour-managed firms further down the aggregation level, and 3) and directed massive capital transfers from the more to the less developed regions. Yugoslavia developed the most decentralised socialist system in the world, symbolising to many a viable market socialist system (Vanek and Jovičić, 1975; Horvat, 1982).

Despite the intention of these institutional changes and policy efforts, initially more developed regions (Croatia, Slovenia and Vojvodina) grew faster than the initially less developed regions (Bosnia-Herzegovina, Kosovo, Macedonia and Montenegro) (implied by figure 1 within a European perspective) (Milanović, 1987; Bateman, Nishimizu, and Page, 1988; Kraft, 1992).[1] Thus, one question arises: why did the less developed regions (LDRs) grow slower than the more developed regions (MDRs), causing regional income divergence?

This paper analyses the proximate sources of growth in Yugoslavia - probably the most peculiar case from which we can learn about the economics of regional development under socialism. I utilise new estimates of output, as well as physical and human capital. I apply standard growth and development accounting methods to construct the regional development trajectories. Since

[1] I follow the existing literature in the categorisation of the more developed and the less developed regions (Milanović, 1987; Bateman, Nishimizu, and Page, 1988; Kraft, 1992). The classification is somewhat simplistic, however, it yields the benefit of easing analytical exposition. It allows me to compare and contrast groups of regions, rather than cumbersomely comparing and contrasting each region to another. Serbia is, however, an intermediate case. It closely tracked the mean and median of Yugoslavia across a range of development indicators. I thus do not treat Serbia as either the more or the less developed region.

Figure 1: GDP per capita of Yugoslav regions relative to the GDP per capita of the Western European core, the European periphery, and Eastern Europe, in %, 1953-89



Notes: GDP p.c. is in 1990 Int. GK$. European subregions are population unweighted. They are classified as in Bolt and van Zanden (2014). Western European core countries are Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Sweden, Switzerland, and the United Kingdom. Peripheral European countries are Ireland, Greece, Spain, and Portugal. Eastern European countries are Albania, Bulgaria, Czechoslovakia, Hungary, Poland, and Romania.
Sources: For Yugoslav regions see section 5. Otherwise, data is taken from Bolt and van Zanden (2014).

Allen (2003) and Cheremukhin, Golosov, Guriev, and Tsyvinski (2015, 2017) argue that reallocation gains associated with the transfer of inputs from agriculture to manufacturing were a major boon to socialist economic growth, I adjust the accounting methods so they can determine the contribution of structural modernisation to aggregate efficiency and hence economic growth.[2]

The analysis of proximate sources of growth provides a useful preliminary diagnostic function before engaging in deeper explorations of the ultimate sources of growth. For instance, If TFP was the main contributor to regional divergence, researchers should focus on analysing factors that distorted efficiency and the accumulation of technology in poorer regions. If, instead, inputs were the main contributor to regional divergence, researchers should focus on analysing factors that distorted the expansion of labour and capital in poorer regions.

[2]More generally, reallocation gains are considered to be a major source of Europe's Golden Age of economic growth during the 1950s and the 1960s (Temple, 2001; Temin, 2002). In this paper, I use the phrases "structural modernisation", "structural change", and "reallocation gains" interchangeably.

I find that the LDRs grew slower than the MDRs because they failed to converge towards the employment rates and total factor productivities (TFP) of the MDRs. I interpret these failures as symptoms of a single underlying factor - a capital intensity bias inherent to the governing objective of labour managed firms. The argument is based on three premises. First, labour-managed firms were attempting to maximise income per worker through substituting capital for labour. Second, the capital intensity bias was particularly strong in the LDRs due to a range of factors, including capital aid and financial repression. Importantly, the bias towards capital intensity was pernicious in the LDRs because they were characterised by labour abundance. Third, substitution of capital for labour retarded employment rates in the LDRs relative to the MDRs. It furthermore caused a divergence in regional TFP trajectories through particularly retarding labour utilisation rates in the LDRs, and by stimulating firms in the LDRs to economise on the relatively abundant factor of production, i.e. labour.

The findings and interpretations of this paper contribute to the literature on economic development in socialist Europe. I provide a spatial dimension to the study of economic growth under socialism, which is otherwise neglected in the existing literature. This neglect seems unusual because egalitarianism was one of the defining features of socialism. There is, however, one practical reason for the paucity of research. There were only two countries in the region during the 20th century characterised by a comprehensive coverage of regional socio-economic indicators - the Soviet Union and Yugoslavia.[3]

The existing literature on economic growth under socialism focuses on analysing the relative contributions of factors of production and TFP to economic growth at the aggregate level. The general aim is to determine the sources of decline of socialist economies. The debate is centred on the nature of the socialist production function. With unit factor substitution, the decline is attributed to diminishing TFP growth (Bergson, 1979, 1987; Gomulka, 1977; van Ark, 1996; Allen, 2003). With low elasticity of factor substitution, the decline is attributed to diminishing marginal product of capital (MPK) (Weitzman, 1970; Desai, 1976; Sapir, 1980; Rusek, 1989; Easterly and Fischer, 1995). I contribute to this strand of literature by moving beneath the aggregate growth patterns. I find that regional growth accounts resist monocausal explanations. TFP was a more important source of growth in the MDRs than it was in the LDRs. The LDRs

[3]With the notable exception of Milanović (1987) and Bateman, Nishimizu, and Page (1988), the existing research on Yugoslavia typically does not dig deeper into the underlying drivers of regional inequality, or the broader implications of increasing regional disparities. This paper makes a novel contribution to this literature by analysing the sources of regional patterns of economic growth.

experienced declining MPK, while the MDRs did not experience declining MPK.

At a more fundamental level, the collapse of socialist economies is attributed to the embedded inefficiencies of socialism (von Mises, 1922/1981; Hayek, 1945; Kornai, 1980). Incentives for innovation and labour were poor (Berliner, 1976; Ofer, 1987), the system was coercive (Harrison, 2002), and unable to adapt to the requirements of flexible production technology (Broadberry and Klein, 2011). The majority of existing studies covering socialist Europe focus on the general features of socialist systems that had no between, and especially no within country differences. Instead, I argue that a single national institution had a differential impact on regional development trajectories. Along the broadly conceived terminology of Abramovitz (1986), labour-managed firms were less technologically congruent with the local factor endowments and other factors in the LDRs than they were in the MDRs.

This paper also contributes to the wider debates concerning global postwar convergence patterns and the (normative) role of aid. During the postwar period, there was strong income convergence among the OECD members. Globally however, the same period was marked by income divergence (see Crafts and O'Rourke (2014) for a survey). This has fuelled the debates about the desirability of aid. In particular, if poor countries are locked in poverty traps because they lack the resources to invest in factors of productions and technology and/or have low incentives to invest because of increasing returns (Azariadis and Stachurski, 2005), aid might enable such countries to escape from poverty traps and achieve successful growth takeoffs (Sachs, 2005).

Yugoslavia is unique in the global perspective in the sense that it tried to integrate high-middle-income (Slovenia), middle-income (Croatia and Vojvodina) and lower-middle-income regions (Serbia), with backward regions (Bosnia-Herzegovina, Macedonia, Montenegro, and Kosovo).[4] It tried to stimulate the integrative processes through capital aid. The experience of Yugoslavia provides a cautionary tale concerning the impact of aid flows. Increased aid flows to developing countries might indeed strongly boost convergence in capital intensities. However, if global differences in the MPK are negligible, or if MPK tends to be higher in poorer countries in the extreme case, this will need to be accompanied by financial repression, as Caselli and Feyrer (2007) argue. Capital outflows will need to be effectively banned in poor countries, as private investment will otherwise flow from poor to rich countries. If so, increased aid flows will be a

[4]Today (2017), the World Bank classifies Croatia and Slovenia as high-income economies, it classifies Bosnia-Herzegovina, Macedonia, Montenegro, and Serbia as upper-middle-income economies, and treats Kosovo as a lower-middle-income economy.

move towards inefficiency, rather than efficiency, just like it seems it was the case in Yugoslavia. It seems unlikely this would lead to successful growth takeoffs.

The remainder of this paper is organised as follows. Section 2 provides a brief overview of decentralisation and regional development policies in Yugoslavia. Section 3 presents the patterns of regional inequality. In section 4, I sketch the theoretical predictions on regional patterns of growth and convergence, and discuss the approach used to decompose labour productivity growth. Section 5 describes the data and the newly constructed variables. Section 6 presents the results, while section 7 provides an interpretation of results based on a combination of institutional and policy-related factors. The final section 8 provides a conclusion.

2 Historical context: Decentralisation and regional development policies

After World War II, the Communist Party seized power. Yugoslavia was reorganised into a federation. The aim was to heal Yugoslavia's ethnic and regional tensions stemming from WWII and the interwar period. Each federal unit approximated the spatial distribution of the major ethnic groups that inhabited the country. The communists adopted a form of government that promised political equalisation to the major ethnicities that formed the country.

In the initial phase of Yugoslavia's socialist experiment, the authorities pursued the standard centrally planned development model of the Soviet Union. The economic system did not differ in any meaningful sense from those that were implemented in the Soviet-dominated countries in Europe (Horvat, 1971). All investment decisions were taken by the federal centre. Regional development policies did not truly exist in this early stage of development (Pleština, 1992).

The 1948 conflict between Tito, the lifelong president of Yugoslavia, and Stalin, the leader of Soviet Union, was a pivotal moment in Yugoslavia's history.[5] As a consequence of the conflict, the Yugoslav communist leadership sought to distance the country from the Soviet Union and its ideology by constructing a unique version of socialism. The Yugoslav communists had to rebrand themselves. The new ideological consensus was that the state should be gradually weakened during the transition to the communist utopia. It was based on the Marxist notion that the state should "wither away" (Jović, 2009). The "withering" of the Yugoslav state can be best perceived as decentralisation of economic and political power. Decentralised, or even

[5] See Rajak (2011) for a description of the episode.

polycentric, socialism was achieved in two ways.

First, political and economic power was transferred from the Federation to the federal units. The turning point was the 1965 socio-economic reform. The federal units obtained the means to stimulate their own economic development. This was partly motivated by the then apparent sharp increase in regional inequality (Bičanić, 1973). The 1965 reforms included the establishment of the "Federal Fund for Crediting Accelerated Development of In-Sufficiently Developed Republics and Autonomous Provinces" (Federal Fund). The Federal Fund was a vehicle which transferred capital from the MDRs to the LDRs. Funds were raised by taxation of firms in the richer regions. The tax was approximately equivalent to 1.9 per cent of their output (Bateman, Nishimizu, and Page, 1988). The recipient regions had full discretion over the allocation of capital aid. This does not mean that the LDRs did not receive federal aid before the establishment of the Federal Fund. Before 1965, capital was directly transferred from the federal investment fund to firms in poorer regions.

In addition to the Federal Fund, the federal centre transferred capital through the federal budget to the regional authorities, earmarked for the expansion of public amenities. On average, according to official statistics, federal aid was equivalent to more than 10 per cent of gross investment in Bosnia-Herzegovina since 1965.[6] It was approximately equivalent to 20 per cent of gross investment in Macedonia and Montenegro. In Kosovo, these transfers amounted on average to approximately 60 per cent of gross investment, reaching extremely high levels during the 1980s.

The effort to reduce the large interregional income differences has primarily consisted of capital aid. Internal trade policies to protect infant industries in the LDRs were prevented in order to stimulate national market integration. Low interregional labour mobility prevented productivity arbitration based on wage differentials (see section 7).

Second, further down the aggregation level, control over prices, output, and enterprise budgets, was gradually devolved to labour-managed firms. Next to ideological reasons, the aim was to eliminate bureaucratic waste and to make firms more responsive to the local environment, and hence to potentially stimulate regional equalisation of incomes through efficiency improvements (Horvat, 1971). Work councils of labour-managed firms, supposedly representing the interests of workers, could, in conjunction with the local government, hire and fire the managers of the enterprise. They could decide, to a degree, on the marketing and production processes of an

[6] *Jugoslavija 1918-1988: Statistički Godišnjak* (Savezni Zavod za Statistiku (1989)).

enterprise. Over time, workers were granted rights over the income derived from fixed assets. Residual income, i.e. income net of depreciation allowances, interest repayments, and similar categories, could be subsequently allocated between wages and investment (Estrin, 1983).

Irrespective of capital aid, the establishment of labour-managed firms led to an effective ban on interregional capital flows. Firms were reluctant to invest in new ventures outside their domicile region because the returns were highly uncertain. The new venture could unilaterally proclaim itself autonomous. If so, investment made by the founding firm would be treated as a credit to be repaid at a low rate of interest. This feature derives from the nature of labour-managed firm. Labour management is impossible if decisions about the firm are to be made by an external investor.

Interregional capital immobility was the intention of federal policy makers. Next to the aforementioned feature of labour-managed firms, the Federal Fund ensured that poorer regions would be able to accumulate capital. Bateman, Nishimizu, and Page (1988) argue that policy makers feared that capital would otherwise flow to richer regions, buttressing regional inequality. Section 7 demonstrates that their fears were justified. The MPK was higher in the MDRs than it was in the LDRs. If capital was mobile, it would have flown from poorer to richer regions, due to higher returns it could have realised there.

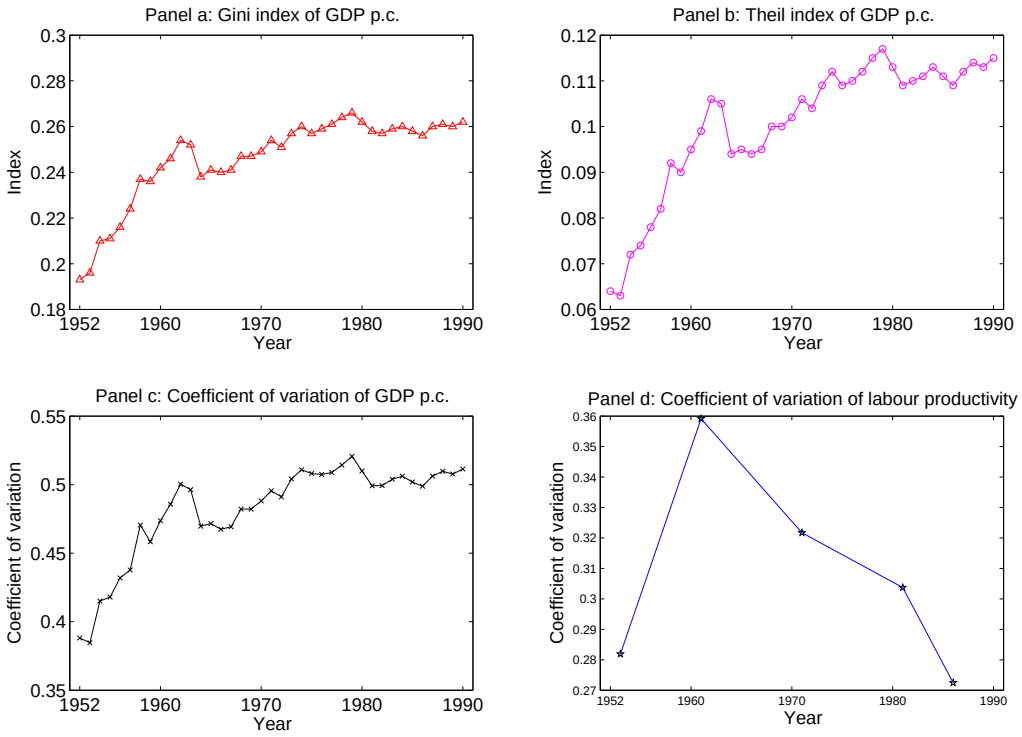
3 Regional inequality

This section presents stylised facts on regional inequality. Figure 1 indicates that Slovenia, Croatia and Vojvodina grew strongly given their initial income levels, converging towards the core countries of Western Europe. Bosnia-Herzegovina and Kosovo, on the other hand, performed poorly. This suggests increasing regional inequality in Yugoslavia.

These growth trends indeed led to income divergence between the Yugoslav regions. Figure 2 displays information on the evolution of inequality through three measures - the Gini coefficient, the Theil index, and the coefficient of variation (CV). All three measures depict the same increasing trend concerning regional income p.c. inequality until the late 1970s (panels a, b, and c in figure 2). During the 1980s, inequality remained roughly constant because economic growth across all regions ceased.

To put Yugoslavia's experience in context; the average regional Gini coefficient for all OECD countries in 2010 stood at 0.16 (OECD, 2013). This is significantly lower than in Yugoslavia

Figure 2: Regional inequality as depicted by the Gini coefficient, coefficient of variation (CV) and the Theil index, 1952-89



Note: Regions are unweighted. Definitions of the Gini coefficient, Theil index and CV are in appendix A.2.
Source: See section 5.

at any point in time. Furthermore, the dispersion of regional income levels in Yugoslavia was higher than the current dispersion of income levels among the member states of the European Union (EU) (see Monfort (2008) for data on EU).

The Yugoslav experience is instead more similar to that of regionally heterogeneous developing countries nowadays. In 2010, in China, India and Brazil, regional Gini coefficient ranged between 0.27 and 0.29 (OECD, 2013). This is similar to historic peak value of Gini coefficient in Yugoslavia in 1979 (0.26). Concerning the evolution of regional inequality in developing countries, it is difficult to find common patterns. Milanović (2005) studies four developing (quasi) federations since about 1980. In China, he finds that regional disparities have overall remained constant, even though inequality has fluctuated between sub-periods. In India and Indonesia he finds increasing inequality. In Brazil he finds no trend. In contrast, Azzoni (2001) studies Brazil over a longer period (1939-95), and finds overall decline.

Notwithstanding these contemporary similarities and differences in regional inequality, compared to other peripheral European countries at a broadly similar level of economic development

during the postwar period, like Greece, Portugal, and Spain, Yugoslavia was the only economy characterised by regional income divergence.[7]

Which proximate factors caused regional income divergence in Yugoslavia? There are three possible explanations: 1) labour productivity, 2) employment, and 3) demography (working-age population rate).[8] Concerning 1), in contrast to regional income p.c. trends, inequality of labour productivity levels remained constant (figure 2.d). The dispersion of labour productivity levels initially increased until 1961. During the subsequent decades, it decreased to a level similar to the one observed in 1953. Concerning 2) and 3), figure 3 reveals that the regional dispersion of employment rates tripled during the sample period, while dispersion of working-age population rates has slightly decreased. The divergence in regional income levels was thus caused by divergence of employment rates, and by the absence of convergence in labour productivity levels. Before assessing why was this the case, it is necessary to analyse the regional sources of labour productivity growth.

4 Theory and methodology

4.1 Theory

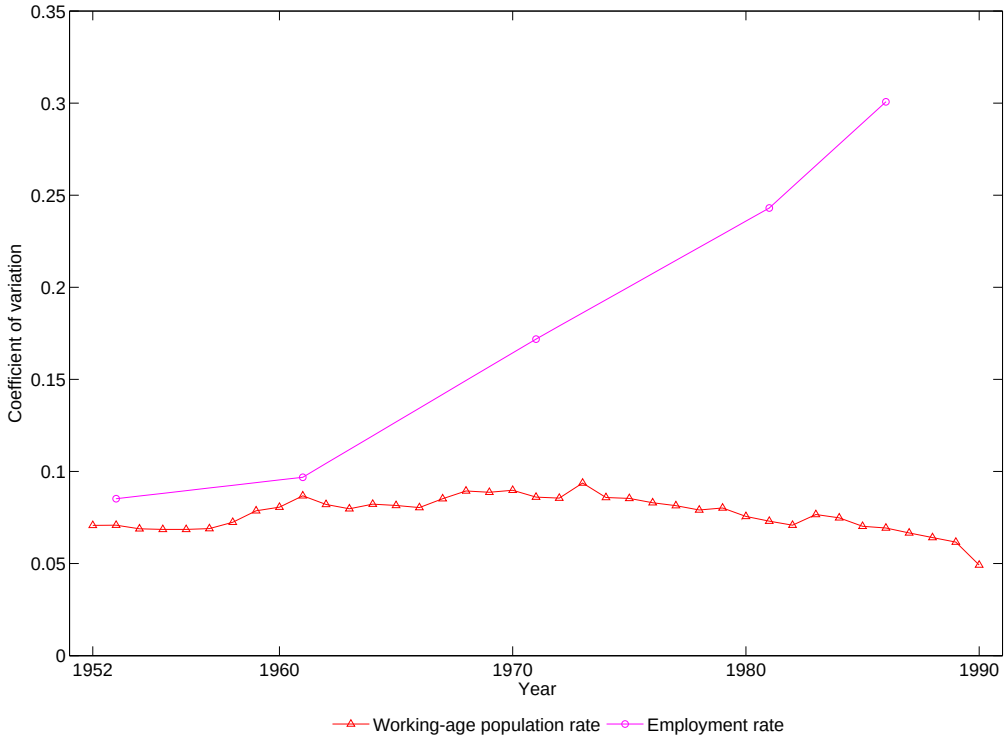
How to study regional development and convergence? Due to high interdependence among regions, this is a complex area of inquiry that involves a multitude of theoretical and empirical approaches (Breinlich, Ottaviano, and Temple, 2014). To impose structure, it is necessary to acknowledge theoretical predictions from economic growth theory. First, the textbook Solow-Swan growth model would predict growth and convergence on the basis of physical and human capital deepening. Poor regions are characterised by capital scarcity of both types, low productivity, and by extension high marginal products of factors of productions. Accumulation of factors, due to higher returns, leads poorer regions to grow faster than the richer regions. In the presence of mobile factors of production, convergence is facilitated by migration of labour to rich regions (where wages are higher), and by migration of capital to poor regions (where rents are higher). These processes cause the equalisation of factor prices and factor proportions.

Second, endogenous growth models view the process of convergence as facilitated through

[7] See Petrakos and Saratsis (2000) for Greece, see Martínez-Galarraga, Rosés, and Tirado (2013) for Spain, and see Badia-Miró, Guilera, and Lains (2012) for Portugal.

[8] Following the Shapley decomposition approach, GDP p.c. can be defined as a function of labour productivity, the employment rate, and a demographic component (working-age population rate): $\frac{output}{\text{overall population}} = \frac{output}{workers} * \frac{workers}{\text{working}-\text{age population}} * \frac{\text{working}-\text{age population}}{\text{overall population}}$.

Figure 3: Inequality of demographic indicators, 1952-1990



Notes: Regions are unweighted. Working-age population rate is the the population aged 15-64 divided by the overall population. Employment rate is labour headcount divided by the working-age population. Sources: Population data is taken from *Vitalna Statistika* (Savezni Zavod za Statistiku, 1950-1954) and *Demografska Statistika* (Savezni Zavod za Statistiku, 1955-1989). Labour data is taken from *Popis Stanovništva* (Savezni Zavod za Statistiku, 1948, 1953, 1961, 1971, 1981).

technological catch-up by poor regions.[9] Third, within a framework of structural modernisation with a long tradition in development economics (Lewis, 1954), a country seizes efficiency gains as it shifts resources from low productivity sectors to high productivity sectors.[10] By extension, the process of regional income convergence is synonymous with the process of convergence in economic structures (Caselli and Coleman, 2001).

In order to acknowledge the first two predictions on growth and convergence, I adopt standard growth and development accounting methods. I decompose regional growth trajectories into the relative contributions of inputs, and the efficiency with which those inputs are used, i.e. TFP. Of course, I do not use an endogenous growth model *per se*. A major drawback of standard growth and development accounting methods is that they are incapable of explaining TFP. Relating the

[9]The phrase "endogenous growth", as Romer (1994) states, encapsulates a diverse body of theoretical and empirical research. The common feature of endogenous growth theory is that it seeks to explain the level and evolution of TFP among and between countries.

[10]Within countries, the dynamics of structural change are more complex and more difficult to estimate (Caselli and Coleman, 2001). Agricultural labour from poor regions might migrate to manufacturing and modern services in the rich regions.

empirical findings to the existing literature on Yugoslav macroeconomic history can partially alleviate this problem.

I assess the contribution of structural modernisation to regional development trajectories by using the Vollrath (2009) dual economy model. Within a development accounting framework, Vollrath (2009) divides the economy into two sectors - agriculture and non-agriculture. I modify his model into a growth accounting exercise to account for the contribution of sectoral input reallocation to aggregate efficiency and hence economic growth.[11] Dividing the economy into two parts is somewhat superficial. But, in case of Yugoslavia, it is appropriate to focus just on agriculture and non-agriculture. Agricultural labour formed more than 70 per cent of total labour in the immediate aftermath of WWII (*Popis Stanovništva*, Savezni Zavod za Statistiku, 1953).

4.2 Methodology

With the aim of estimating efficiency associated with the sectoral allocation of resources, aggregate labour productivity, $\frac{Y}{L}$, is assumed to be derived from agriculture and non-agriculture (Vollrath, 2009):

$$\frac{Y}{L} = \frac{Y_a}{L} + \frac{Y_{na}}{L} \tag{1}$$

where Y_a denotes agricultural output, and Y_{na} denotes non-agricultural output. Since Y_a and Y_{na} are divided by total labour, L , $\frac{Y_a}{L}$ and $\frac{Y_{na}}{L}$ measure the contribution of agriculture and non-agriculture to aggregate labour productivity, respectively. Output in each sector is generated by the following Cobb-Douglas production function:

$$Y_a = A_a R_{a,t}^{\gamma} K_a^{\beta} (hL)_a^{1-\gamma-\beta} \tag{2}$$

and:

$$Y_{na} = A_{na} K_{na}^{\alpha} (hL)_{na}^{1-\alpha} \tag{3}$$

where R is agricultural land, K is physical capital, and h is per capita human capital of the labour force. The term hL denotes labour augmented by quality (human capital), while A denotes efficiency with which inputs are used to produce output (TFP). In agricultural production function (equation 4), γ is the elasticity of output with respect to land, β is the elasticity of

[11] Appendix A.3 provides a set of advantages the Vollrath (2009) model provides compared compared to the existing literature.

output with respect to physical capital, and $1-\gamma-\beta$ is the is the elasticity of output with respect to human capital. The agricultural production function is consistent with a long tradition of modelling agriculture (Hayami and Ruttan, 1970).

The non-agricultural production function in equation 3 matches the standard formulation of aggregate production function in Hall and Jones (1999). It does not include land. Concerning output elasticities, α denotes the elasticity of output with respect to physical capital, and $1-\alpha$ denotes the elasticity of output with respect to human labour. Both sectors are thus characterised by constant returns to scale because elasticities in each sector must sum to unity.[12] Assuming perfectly competitive markets, the elasticity of output with respect to its input is measured by the share of input compensation in output.

In order to conduct a growth accounting exercise, equation 1 can be rewritten as:

$$\frac{\dot{y}}{y} = \frac{\dot{y}_a}{y} + \frac{\dot{y}_{na}}{y} \tag{4}$$

where a lower case letter denotes a variable expressed in per worker terms, and a dot over a variable denotes its time derivative.[13] Equation 4 defines aggregate labour productivity growth as the weighted sum of agricultural and non-agricultural labour productivity growth. The existence of this aggregate production does not depend on the problematic assumption of an optimal resource allocation within an economy (Banerjee and Duflo, 2005).

To determine the weighted sectoral contribution of inputs and TFP to aggregate labour productivity growth, take the total differential of production functions in equations 2 and 3, and divide by Y. Subsequently, the first term on the right-hand side of equation 4 expands into:

$$\frac{\dot{y}_a}{y} = s\frac{\dot{A}_a}{A_a} + \rho\frac{\dot{r}_a}{r} + \kappa\frac{\dot{k}_a}{k} + (1-\rho-\kappa)\frac{\dot{h}_a}{h} \tag{5}$$

where s is the share of agricultural output in total output, ρ is the share of agricultural land in total output, κ is the share of physical capital in total output, and $1-\rho-\kappa$ is the share of human capital in total output. The second term on the right-hand side of equation 4 expands

[12] The assumption of constant returns to scale is corroborated by empirical research. Boyd (1987) estimates the Yugoslav agricultural production function. He finds that the elasticity of agricultural output with respect to each input summed to 0.99. Sapir (1980) estimates the Yugoslav manufacturing production function. He finds that the elasticity of manufacturing output with respect to each input summed to 1.

[13] The growth accounting exercise is expressed in terms of continuous time to conduce clarity of exposition by reducing notational clutter. The actual calculations are performed using a standard translog production function.

into:

$$\frac{\dot{y}_{na}}{y} = (1-s)\frac{\dot{A}_{na}}{A_{na}} + \kappa\frac{\dot{k}_{na}}{k} + (1-\rho-\kappa)\frac{\dot{h}_{na}}{h} \tag{6}$$

Substituting equations 5 and 6 into equation 4 yields the aggregate production function similar to Temple (2001):

$$\frac{\dot{y}}{y} = \frac{\dot{A}}{A} + \rho\frac{\dot{r}_a}{r} + \kappa\frac{\dot{k}}{k} + (1-\rho-\kappa)\frac{\dot{h}}{h} \tag{7}$$

where:

$$\frac{\dot{A}}{A} = s\frac{\dot{A}_a}{A_a} + (1-s)\frac{\dot{A}_{na}}{A_{na}} \tag{8}$$

$$\dot{k} = \dot{k}_a + \dot{k}_{na} \tag{9}$$

and:

$$\dot{h} = \dot{h}_a + \dot{h}_{na} \tag{10}$$

Equation 7 does not explicitly incorporate efficiency gains derived from the reallocation of human and physical capital to more productive uses. Such efficiency gains are implicitly reflected in $\dot{A}$, and form some fraction of aggregate TFP growth. In order to explicitly estimate efficiency gains associated with the reallocation of inputs, note that first order conditions require identical marginal products, MP, of inputs, i, employed in each sector (Ngai and Pissarides, 2007; Herrendorf, Rogerson, and Valentinyi, 2014). However, in a developing country like Yugoslavia this likely condition did not hold:

$$MP_{a,i} \neq MP_{na,i} \tag{11}$$

An economy with a sectoral marginal product gap (equation 11) is characterised by an inefficient sectoral allocation of inputs. This implies that such an economy is characterised by frictions. These frictions distort the reallocation of inputs from the less productive sector to s more productive sector. In turn, a decrease of these frictions yields aggregate efficiency gains as inputs move to a more productive use in another sector. An economy can seize these efficiency gains until the sectoral marginal products are equalised. That is, until $MP_{a,i} = MP_{na,i}$.

To formalise these ideas, treat any efficiency Z derived from the sectoral allocation of inputs as as the ratio of actual to potential labour productivity (y^*):

$$Z = \frac{y}{y^*} \tag{12}$$

where potential output is a hypothetical output level in the absence of a marginal product gap (if: $MP_{a,i} = MP_{na,i}$). Z can be interpreted as measuring the fraction of potential output that an economy is actually achieving given its factor endowments and sector-specific TFP's (Vollrath, 2009). An economy will approach its potential output through decreasing the marginal product gap. At a more technical level, the derivation of potential output involves finding the share of human and physical capital in agriculture that maximises output. Since the calculus is somewhat tedious, I report the details in appendix A.3, alongside a set of entailed assumptions.

Upon estimating Z, aggregate TFP, A, can be perceived as a function of efficiency derived from the sectoral allocation of resources, and other categories of efficiency, A_E. Formally, within a growth perspective, equation 8 can be redefined as:

$$\frac{\dot{A}}{A} = \frac{\dot{A}_E}{A_E} + \frac{\dot{Z}}{Z} \tag{13}$$

where the reallocation gain, Z, is measured as a change in the ratio of actual to potential income. I assume that an improvement in the ratio of actual to potential income leads to a one-to-one increase in economic growth. Substituting equation 13 into equation 7 yields the growth accounting exercise of this paper:

$$\frac{\dot{y}}{y} = \frac{\dot{A}_E}{A_E} + \frac{\dot{Z}}{Z} + \rho\frac{\dot{r}_a}{r} + \kappa\frac{\dot{k}}{k} + (1-\rho-\kappa)\frac{\dot{h}}{h} \tag{14}$$

where A_E is aggregate TFP adjusted for efficiency gains associated with reallocation of physical and human capital to a more productive use in another sector. It is the TFP growth I report in section 6.1. It is estimated as residual growth after accounting for the contribution of reallocation gains and input growth to aggregate labour productivity growth.

5 Data

This section describes data. I primarily rely on official sources, but I make adjustments to official data where necessary. A more detailed data description is provided in appendix A.1. In order to minimise measurement problems, the analysis is conducted on the basis of five benchmark years - 1953, 1961, 1971, 1981 and 1986. The first four are centred on labour data derived from population censuses. The last year is based on an employment census. I do not use the last 1991 Yugoslav census as it is incomplete for some regions. All monetary figures are converted

to 1990 International Geary-Khamis dollars.

5.1 Output

Social Product (SP) was the official indicator of output in Yugoslavia. SP is the conceptual equivalent of the Gross Domestic Product (GDP). The growth rate of SP is however overestimated because of index number problems (Gerschenkron, 1947), distorted prices (Staller, 1986), hidden inflation (Nove, 1981), and possibly because of firm's over-reporting of input requirements in order to maximise the allocation of resources within a shortage economy (see Ofer (1987) for an overview). On the other hand, SP growth rates could be partially underestimated because the rapidly growing non-market services - education, healthcare, culture, and housing - were excluded from SP. Non-market services were considered to be "non-productive" sectors which did not contribute to the value-added of a socialist economy.

Due to aforementioned issues, a group of Western scholars estimated the GDP series of socialist European countries. They did it in a set of publications entitled "Research Project on National Income in East Central Europe" (Research Project).[14] The Research Project estimated the GDP of Yugoslavia and its sectors. It did not estimate the GDP of Yugoslav regions. Two issues related to SP mentioned in the above paragraph might distort the level and evolution of regional inequality.

First, price distortions could matter. Prices of agricultural goods were set below world prices, while prices of industrial goods were set above world prices. This implies that official data assigns a greater share of Yugoslav output to the more industrial regions than it corresponded to the actual state, magnifying the level of regional inequality.

Second, since the MDRs were likely characterised by a larger share of non-market services in their total output than the LDRs were, the official level of regional inequality might be underestimated. The net impact of these two biases on the level of regional inequality is ambiguous. The impact of these two biases on the evolution of regional inequality is, however, unambiguous. If the LDRs converged towards the sectoral structure of the MDRs, official data overestimates the true extent of regional income divergence.[15]

[14] Their publications that cover the 1945-1990 period include Alton (1970) and Alton, Badach, Bass, Bakondi, Brumaru, Bombelles, Lazarcik, and Staller (1992).

[15] Of course, it could also be the case that other statistical biases distort the evolution of regional inequality. For instance, official evolution of regional inequality will be distorted if firms in some regions over reported input requirements to a larger extent than firms in other regions. Unfortunately, it is impossible to speculate about the significance of such effects in the absence of research.

Table 1: Compound annual growth rate of real output, 1952-89, in %

	Official data	Alternative data	Ratio of alternative to official data
Yugoslavia	5.11	4.75	0.93
Bosnia-Herzegovina	4.70	4.55	0.97
Croatia	4.95	4.59	0.93
Kosovo	5.17	5.11	0.99
Macedonia	5.38	4.96	0.92
Montenegro	5.06	4.55	0.90
Serbia	5.12	4.68	0.91
Slovenia	5.33	4.97	0.93
Vojvodina	5.65	5.10	0.90

Note: Official data is expressed in 1972 dinars. Alternative data is expressed in 1990 Int. GK$.
Sources: See appendix A.1.1.

I assess whether price distortions and the excluded non-market services bias relative regional growth trajectories by re-estimating regional sectoral outputs. I do it in two steps. First, to eliminate price distortions, I apply international prices to the agricultural and non-agricultural sectors. In the second step, I estimate the output of non-market services through the size of regional non-market service wage bills.[16] The regional GDPs are anchored by the Yugoslav aggregate and sectoral output estimated by the Research Project. I thus keep the value of Yugoslavia's aggregate and sector-specific GDP as estimated by the Research Project, but provide new regional GDPs.

Table 1 compares the official and alternative output growth rates. On average, it seems that government statisticians overestimated the average annual growth rate of the MDRs (8 per cent for the average of Croatia, Slovenia and Vojvodina) to a larger extent than the average annual growth rate of the LDRs (6 per cent for the average of Bosnia-Herzegovina, Kosovo, Macedonia, and Montenegro). However, the dynamics of output growth overestimation are more complex at the level of individual regions. In sum, it does seem that official data overestimates the extent of regional income divergence, but to a small and potentially negligible extent. In appendix A.4.4, I conduct growth and development accounting exercises with official output data. The results are qualitatively identical to the baseline case where I use the newly constructed output data.

[16] I estimate the output of non-market services through the factor cost method, which the Research Project used as well. My methodology is thus internally consistent with that of the Research Project. Note, however, that I account for only labour cost, but not capital cost. Unfortunately, it is not possible to account for interregional cross subsidisation and taxation of capital, which would be necessary to do when estimating output at factor cost.

5.2 Inputs

I use official data on gross investment.[17] But, I exclude a category called "other". I omit this category because it includes expenditure on product research and training of personnel, which is not part of physical capital. Moreover, it includes changes in the value of inventory. This is problematic because Madžar (1985) reports that value of inventory has been substantially overestimated during the inflationary environment of the 1970 and the 1980s. The exclusion of the category "other" decreases total investment by approximately 10 per cent across Yugoslavia during the 1953-86 period.

Physical capital is composed of four asset categories: residential structures (dwellings), non-residential structures, equipment, and livestock. Non-agricultural capital includes the first three assets, while agricultural capital consists of the last three assets. Annual net capital stock is estimated using the perpetual inventory method with geometric depreciation:

$$K_{i,t} = K_{i,t-1}(1 - \delta_i) + I_{i,t} \tag{15}$$

where K denotes capital stock in period t of type i. I denotes gross investment and δ denotes the deprecation rate. Depreciation rate for each asset is taken from Hulten and Wykoff (1981).[18] I rely on Vinski (1959) to initialise the 1953 capital stock series by type. After constructing the time series for each asset type, I sum these into an unweighted aggregate. The capital stock is therefore not adjusted for quality. In the absence of a capital market, it is not possible to estimate the returns to capital by type, with which different assets could be otherwise weighted and adjusted for quality.

The value of agricultural land is initialised through Vinski (1959) as well. The evolution of agricultural land is projected through the volume of land provided in official statistics.[19]

Labour data is taken from official sources and is adjusted for hours worked.[20] Labour is

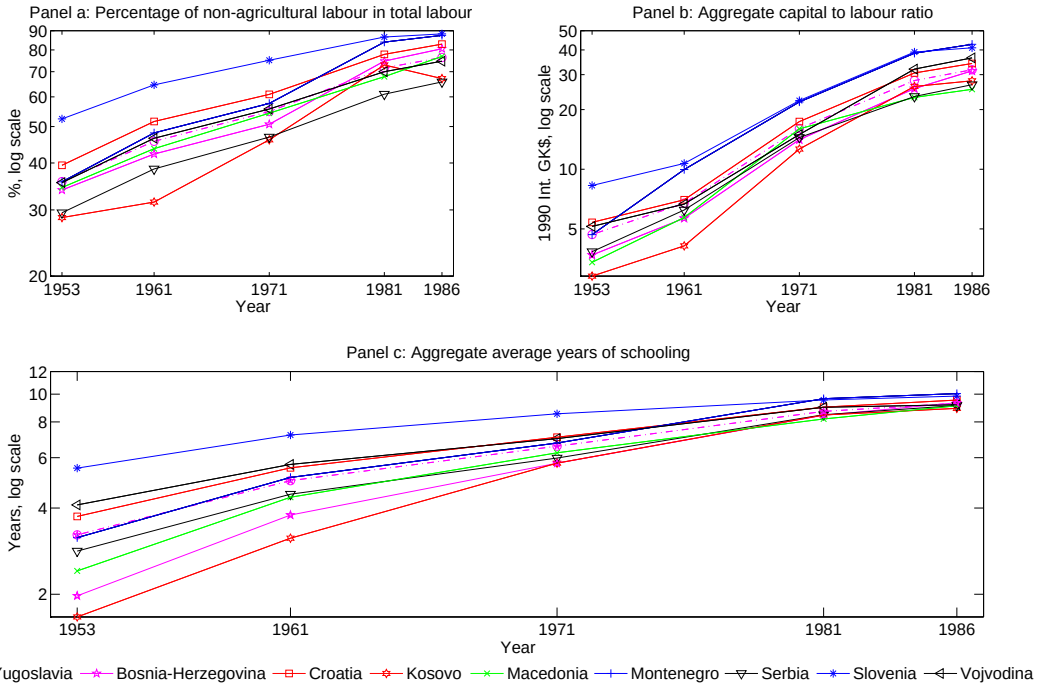
[17] *Investicije u Osnovna Sredstva SFR Jugoslavije, Socijalističkih Republika i Socijalističkih Autonomnih Pokrajina 1952-1981, u Cenama 1972.* (Savezni Zavod za Statistiku, 1983a) and *Investicije* (Savezni Zavod za Statistiku, 1982-1989).

[18] I take an unweighted average of the assets likely to be found within each sector-specific capital input. This approach yields depreciation rates of 15.1 and 3.7 per cent for non-agricultural machinery and non-residential structures, respectively. It yields depreciation rates of 17.1 and 2.4 per cent for agricultural machinery and non-residential structures, respectively. Depreciation rate for residential structures is assumed to be 1.3 per cent like in Hsieh (2002). In appendix A.4.2 I experiment with alternative depreciation rates. The results remain qualitatively very similar to the baseline findings in section 6.

[19] *Statistički Godišnjak SFR Jugoslavije* (Savezni Zavod za Statistiku, 1952-1991).

[20] Headcount of labour is taken from *Popis Stanovništva* (Savezni Zavod za Statistiku, 1948, 1953, 1961, 1971, 1981), *Statistički Godišnjak SFR Jugoslavije* (Savezni Zavod za Statistiku, 1987), and ILO (online). Average annual hours worked are derived from *Statistički Godišnjak SFR Jugoslavije* (Savezni Zavod za Statistiku, various

Figure 4: Regional macroeconomic data, 1953-86



Notes: Labour is total hours worked.
Sources: See text.

augmented by quality through the mincerian approach, following Hall and Jones (1999). Average years of schooling for sector-specific labour are constructed from official sources.[21] Average years of schooling are turned into mincerian human capital by adjusting for the returns to education relative to labour without education. Returns to education are assumed to be piecewise linear. Following Hall and Jones (1999), I assume that the return to education under 4 years of schooling is 13.4 per cent, between 4 and 8 years of schooling it is 10.1 per cent, and above 8 years of schooling it is 6.8 per cent.[22]

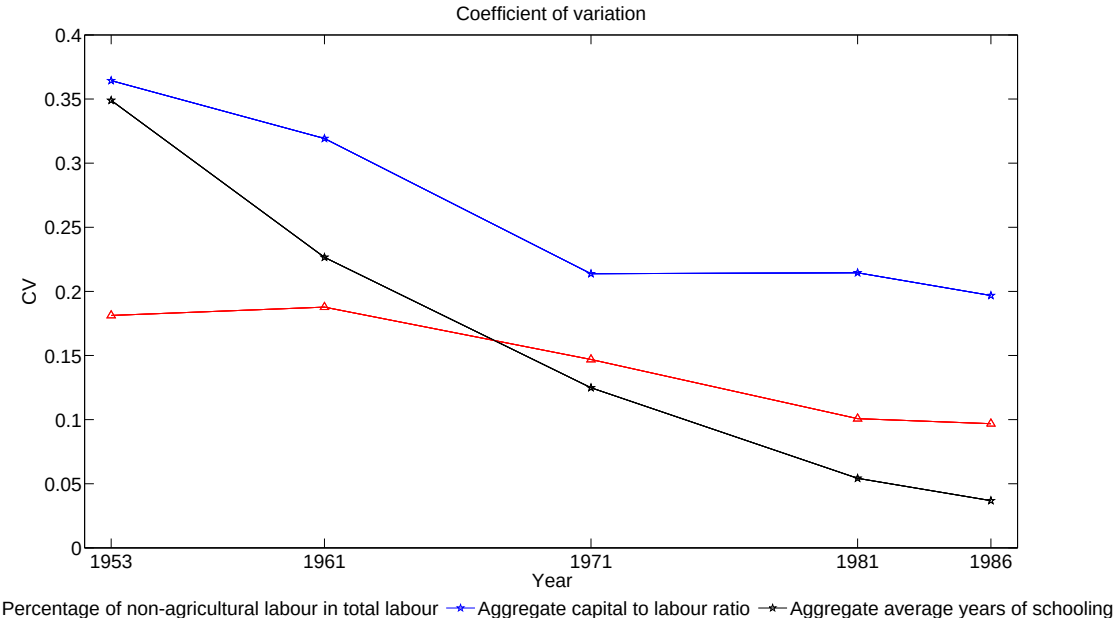
Figure 4 reports some of the newly constructed macroeconomic aggregates. It suggests that LDRs strongly converged towards the physical and human capital intensities of the MDRs (panels b and c). It seems that their economic structures have strongly converged as well (panel a). Indeed, figure 5 shows that the CV of the percentage share of non-agricultural employment in total employment, the capital to labour ratio, and the average years of schooling, has strongly decreased.

years).

[21] *Popis Stanovništva* (Savezni Zavod za Statistiku, 1948, 1953, 1961, 1971, 1981) and *Statistički Godišnjak SFR Jugoslavije* (Savezni Zavod za Statistiku, 1991).

[22] I assume that the returns to education are identical in agriculture and non-agriculture. There is remarkably little evidence on returns to education in agriculture. In appendix A.4.3 I experiment with alternative returns to years of schooling. The results remain qualitatively very similar to the baseline findings in section 6.

Figure 5: CV of regional macroeconomic data, 1953-86



Sources: See text.

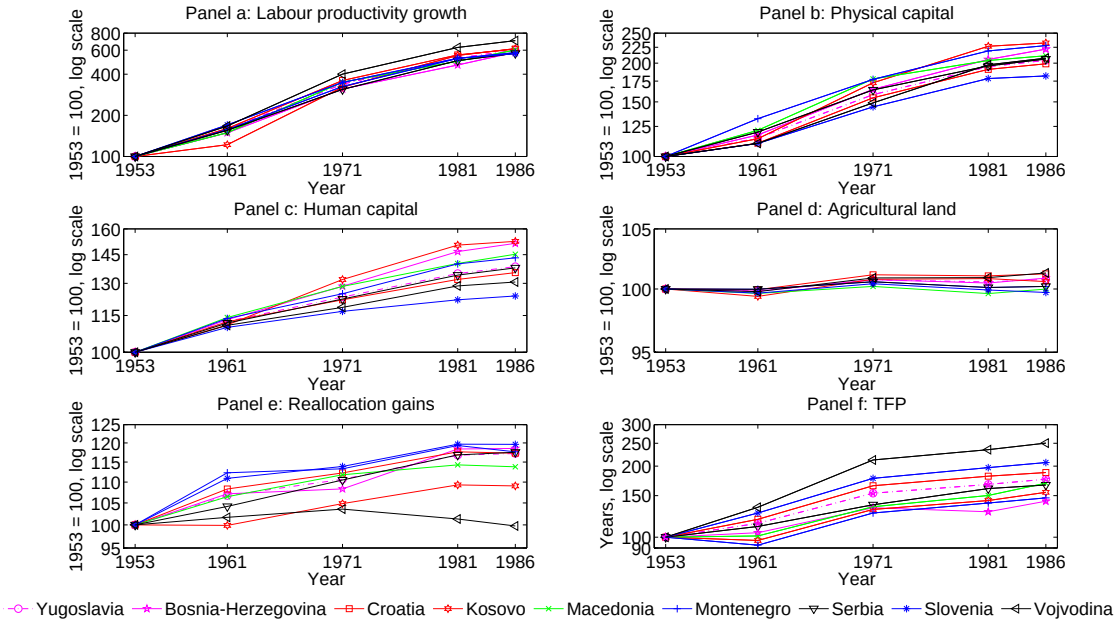
5.3 Factor shares

The sector-specific income compensation of labour and capital is estimated from the national accounts.[23] I assume that regional factors shares are identical because it is not possible to estimate factor shares at a regional level.[24] In non-agriculture, the estimated average output share of capital is 0.43. This is similar to the often estimated capital share in socialist countries for the aggregate economy (Easterly and Fischer, 1995). In agriculture, the estimated average output share of capital in agriculture is 0.19. Given the data availability of Yugoslav national accounts, it is not possible to estimate the land share of agricultural output. Instead, I take the land share from Boyd (1987). He reports that the land share of agricultural output in Yugoslavia was 0.24. Given these factors shares, the labour share in both sectors is identical (0.57). For the aggregate economy, factor shares are imputed as the weighted average of the corresponding factor shares in agricultural and non-agricultural output. Labour share in aggregate output is thus 0.57, capital share is 0.38, and land share is 0.05. These estimations are very similar to the aggregate output shares of labour, capital and land Bergson (1961) finds for the Soviet Union.

[23] *Statistički Godišnjak SFR Jugoslavije* (Savezni Zavod za Statistiku, 1952-1991).

[24] This seems justified. After accounting for income derived from self-employment, Gollin (2002) finds that labour shares are approximately constant in international cross-section data. Nevertheless, in appendix A.4.1 I experiment with alternative labour shares. I attach different labour shares to LDRs and the MDRs. The results remain qualitatively very similar to baseline findings in section 6.

Figure 6: Sources of cumulative growth, 1953-86, 1953=100



6 Results

6.1 Growth accounting

Figure 6 depicts the sources of cumulative labour productivity growth over the benchmark of five years. Table 2 shows the sources of aggregate economic growth in Yugoslavia during the overall 1953-86 period in greater detail. I ignore the sectoral contribution to aggregate labour productivity growth because the contribution of agriculture was negligible. According to table 2, of the annual 5 per cent growth in aggregate output for Yugoslavia, the growth in labour productivity contributed 5.4 per cent. The remainder was due to negative growth of the labour supply. Within a European post-war perspective, average annual labour productivity growth rate of 5.4 per cent over more than thirty years is very high (see table 12.7 in Crafts and Toniolo (2010)).

Table 2 decomposes the sources of labour productivity growth into contributions of physical and human capital, reallocation gains associated with a more efficient sectoral allocation of human and physical capital, and TFP. The last column depicts the variance of a variable. A high variance on a source of growth indicates that a large fraction of differences in growth performance across regions can be explained by that source of growth.

The main source of growth in all regions, expect in Slovenia and Vojvodina, was physical capital deepening. As indicated before by figures 4 and 5, the LDRs experienced a much greater

Table 2: Sources of growth, 1953-86, in %, average compound annual growth rate

	YUG	BIH	CRO	KOS	MK	ME	SRB	SLO	VOJ	σ^2
Aggregate output	5.02	4.85	4.82	5.39	5.30	5.25	4.90	5.39	5.19	0.05
Aggregate labour	-0.41	-0.49	-0.67	-0.12	-0.15	-0.06	-0.37	0.14	-0.73	0.08
Labour productivity	5.43	5.33	5.49	5.51	5.45	5.31	5.27	5.26	5.92	0.04
Of which:										
Physical capital	2.19	2.45	2.11	2.60	2.30	2.53	2.22	1.83	2.24	0.05
Human capital	0.99	1.26	0.92	1.29	1.14	1.10	0.98	0.65	0.81	0.04
Land	0.02	0.03	0.04	0.02	0.00	0.01	0.02	-0.01	0.04	0.00
Reallocation gains	0.48	0.52	0.49	0.26	0.39	0.50	0.49	0.55	-0.01	0.03
TFP	1.73	1.08	1.93	1.34	1.62	1.18	1.56	2.24	2.83	0.31
Percentage of labour productivity growth due to:										
Factors of production	59.13	70.11	55.95	70.82	63.10	68.44	61.15	47.05	52.26	66.94
Reallocation gains	8.90	9.70	8.83	4.79	7.22	9.33	9.32	10.38	-0.12	10.89
TFP	31.97	20.19	35.22	24.40	29.68	22.22	29.53	42.57	47.86	84.47

Notes: YU = Yugoslavia, BIH = Bosnia-Herzegovina, CRO = Croatia, KOS = Kosovo, MK = Macedonia, ME = Montenegro, SRB = Serbia, SLO = Slovenia, VOJ = Vojvodina, and σ^2 = variance.

contribution of physical capital to labour productivity growth than the MDRs did, suggesting that physical capital deepening contributed towards regional convergence.

The accumulation of human capital followed a similar pattern as the accumulation of physical capital. The expansion of human capital was a significant source of growth across all regions. Suggestively, it was an important source of labour productivity convergence as well. The highest annual contribution of human capital deepening to labour productivity growth among the MDRs was 0.9 per cent in Croatia, while the lowest annual contribution of human capital among the LDRs was 1.1 per cent in Montenegro. The contribution of land was generally irrelevant. Land supply was fairly fixed across Yugoslavia.

Reallocation gains were a less important source of growth than human capital, but they were nevertheless substantial. I am able to eliminate on average one quarter of conventionally measured TFP growth by accounting for reallocation gains. In Bosnia-Herzegovina, Croatia, Macedonia, Serbia, and Slovenia, reallocation gains significantly boosted labour productivity growth. It seems that reallocation gains contributed towards labour productivity convergence as well, but only slightly. On average, annual reallocation gains among the LDRs were 0.42 per cent, while among the MDRs they were 0.34 per cent.

Finally, the variance of TFP growth rates was big. The variance of TFP growth was highest among all the sources of growth by a significant margin (last column of table 2). In Slovenia, TFP was the main source of growth. In all other regions it was of second-order or third-order importance. The results strongly suggest that differential TFP gains diminished regional labour productivity convergence. The lowest annual growth rate of TFP among the MDRs was 1.9 per

cent in Croatia, while the highest annual TFP growth rate among the LDRs was 1.6 per cent in Macedonia.

Across all regions except Slovenia, the growth of labour productivity growth was mostly caused by factor accumulation. This mirrors the general finding in the economic growth literature that most of output growth across countries can be accounted for by input growth (for a literature survey, see Hsieh and Klenow (2010)). Nevertheless, there was strong regional variation to it. In Kosovo as a maximum, factor accumulation accounted for 71 per cent of labour productivity growth. In Slovenia as a minimum, factor accumulation counted for 47 per cent of labour productivity growth.

6.2 Development Accounting

Since TFP grew faster in the MDRs than in the LDRs, while factors accumulated and reallocated faster in the LDRs, TFP likely mitigated regional labour productivity convergence. In this section, I determine the percentage of regional variation in labour productivity levels that can be explained by TFP. To get a sense of convergence dynamics, I do this over a span of five benchmark years.

I perform two development accounting exercises. In the first one, I establish a hypothetical labour productivity level, y^{**}, a region i would have if it had a) Slovenian sector-specific TFP's (productivity leader), and b) maximised its labour productivity over the sectoral allocation of resources. Similar to Caselli (2005) and Vollrath (2009), the development accounting exercise is conducted as:

$$Raw\ TFP = 1 - \frac{var(ln\ y_i^{**})}{var(ln\ y_i)} \tag{16}$$

where the ratio "raw TFP" estimates how much of the total variation in labour productivity levels can be accounted by TFP. The higher is the ratio, the higher is the variation in labour productivity that can be accounted by raw TFP. I call this ratio raw TFP because it incorporates a subset of income variation caused by a sectoral (mis)allocation of resources. This ratio corresponds to TFP measure A in section 4.2. The results are presented in column 1 of table 3. In 1953, raw TFP accounted for 30 per cent of regional variation in labour productivity levels. The importance of TFP in accounting for regional productivity differentials increased over time. By 1971, raw TFP accounted for more than 80 per cent of labour productivity variation.

The second development accounting exercise is similar to the first one. However, I subtract

Table 3: TFP as a source of regional labour productivity level differentials, in %

	(1) Raw TFP	(2) Adjusted TFP
1953	30.6	52.1
1961	68.8	67.2
1971	83.4	82.0
1981	84.9	86.1
1986	84.9	89.5

from raw TFP ratio a variation in labour productivity caused by the sectoral allocation of human and physical capital:

$$Adjusted\ TFP = Raw\ TFP - \left(1 - \frac{var(ln\ y_i^*)}{var(ln\ y_i)}\right) \tag{17}$$

where y^* is potential labour productivity level a region would have if it maximised its labour productivity over the sectoral allocation of resources, just like in section 4.2. Ratio "adjusted TFP" corresponds to TFP measure A_E in section 4.2, which is TFP after accounting for re-allocation gains. The result of this development accounting exercise are presented in column 2 of table 3. In 1953, adjusted TFP accounted for 52 per cent of regional variation in labour productivity levels. This is a larger magnitude compared to results in column 1. This means that labour productivity inequality would have been higher than in the actual state if all regions maximised labour productivity over their sectoral allocation of resources. Just like for raw TFP, the importance of adjusted TFP in accounting for regional productivity differentials substantially increased over time. Adjusted TFP accounted for more than 80 per cent of labour productivity variation by 1971.

The role of TFP in accounting for income difference across Yugoslavia after the 1950s is much higher than what cross-country development accounting exercises typically find at a global level. For example, Klenow and Rodriguez-Clare (1997); Hall and Jones (1999); Caselli (2005) and Vollrath (2009) find that TFP accounts for about 50 per cent of cross-country income differences.

6.3 Robustness checks

In appendix A.4, I provide a detailed description of the sensitivity of my results to alternative labour shares, depreciation rates, returns to years of schooling. and data. I design the sensitivity tests to go against my baseline findings. I design them so as to increase TFP in the LDRs relative to TFP in the MDRs. Although the exact quantitative significance of TFP in determining the

sources of growth rates and the variation in labour productivity levels changes, the impact of TFP under different settings remains qualitatively identical or very similar to the baseline setting. Under a variety of alternative settings, 1) MDRs experience higher TFP growth rates than the LDRs, and 2) TFP gradually accounts for a larger fraction of income differences in Yugoslavia. In appendix A.4, I also provide a detailed description of how some assumptions affect my results, like constant returns to scale, unit elasticity of substitution between capital and labour, and other assumptions related to the estimation of reallocation gains. I further rationalise the justification of these assumptions for Yugoslavia. Deviations from some of these assumptions would strengthen my baseline findings.

7 Interpretation of results

To summarise the results: regional income divergence in Yugoslavia was caused by the inability of the LDRs to converge towards the employment rates and TFP levels of the MDRs. This section provides an interpretation of these findings. I argue that the evolution of TFP and the employment rate was intrinsically linked. These two factors in the LDRs were retarded by a single underlying problem: a capital intensity bias inherent to the governing objective of labour-managed firms.

7.1 Capital intensity bias

Ward (1958); Vanek (1970) and Meade (1972) argue that labour-managed firms maximised income per worker. That objective was achieved in two complementary ways. First, work councils of labour-managed firms were incentivised to accumulate capital in an environment characterised by a low rental rate of capital. Capital accumulation, facilitated by cheap capital, caused income generation. It therefore led to a larger income for the members of labour-managed firms.

Three factors decreased the rental rate of capital, stimulating capital accumulation. First, the cost of capital was decreased through setting interest rates to very low or even negative levels (Horvat, 1971; Uvalić, 1992). Second, and related to the previous point, labour-managed firms were implicitly subsidised through the redistributive effects of holding financial assets and liabilities in an inflationary environment. Financial claims were generally not inflation-indexed, while assets generally were (Kraft and Vodopivec, 1992), boosting the equity position

of companies. Third, the state revenue structure relied on labour income taxation that decreased the cost of capital relative to the cost of labour (Bateman, Nishimizu, and Page, 1988).

Work councils also maximised income per worker by restricting labour entry. They thereby increased average incomes of the firms existing members due to declining marginal product of labour. Through expanding capital and restricting labour entry labour-managed firms thus substituted capital for labour (Vanek, 1977; Sapir, 1980). Given that workers were appropriating capital income (Vanek and Jovičić, 1975), a logical consequence of income maximisation would be the existence of large disparities in income levels of workers with similar characteristics among firms that differed in their capital to labour ratios. Indeed, these disparities are well documented (Estrin, 1991).

The capital intensity bias was intensified in the LDRs through four means. First, the regional development policy consisted of capital aid. Capital aid made capital less scarce than otherwise, further decreasing the cost of capital in the LDRs.

Second, the literature reports that capital aid was primarily channeled into heavy industries characterised by intrinsically high capital intensities (Lydall, 1989; Dyker, 1990; Lampe, 2000), magnifying the capital intensity bias within the LDRs.[25] Dyker (1990) argues that that political structures in the poorer regions were acutely afflicted by the "investment good fetishism" - a tendency to envisage economic development in terms of spectacular capital intensive projects (e.g. steelworks). Alternatively, but not mutually exclusive, political structures in the LDRs perhaps attempted to develop high-margin heavy industries for rent-extraction purposes, just like Young (2000) argues is the case with regional political elites in China.

Third, irrespective of capital aid, Kraft and Vodopivec (1992) find that LDRs received more (quasi) subsidies than the MDRs concerning capital accumulation. The most important subsidy took the form of gains on money - repayment of liabilities at negative real interest rates.

Finally, and perhaps most importantly, the substitution of capital for labour was particularly anomalous in the LDRs because they were characterised by a relative abundance of labour. As shown by panel a in figure 4, the LDRs were characterised by very high agricultural employment shares, and potentially surplus labour. Furthermore, the LDRs were characterised by much higher unemployment rates than the MDRs were. For example, from the mid-1960s, the unemployment rate in Kosovo was higher than 20 per cent, while the unemployment rate in Slovenia ranged between 1 to 4 per cent.[26]

[25] As anecdotal evidence, see the case study of Kosovo's Trepča mining enterprise in Palairet (2003).

[26] *Jugoslavija 1918-1988: Statistički Godišnjak* (Savezni Zavod za Statistiku (1989)). Of course, high unem-

7.2 Hypothesised impact on employment and TFP

How is the capital intensity bias related to the regional divergence in employment rates and TFP? The hypothesised impact on employment is clear-cut. Labour-managed firms maximised income per worker through substituting capital for labour. This particularly retarded employment rates in the LDRs (figure 3) because the capital intensity bias was stronger there. The hypothesised impact of the capital intensity bias on TFP is slightly more subtle. It had a two-fold impact. Both impacts are extended effects of the impact of the capital intensity bias on the employment rate.

First, the capital intensity bias likely caused a low and possibly declining labour utilisation rate. If not accounted for, utilisation rate is reflected in TFP (Burnside, Eichenbaum, and Rebelo, 1993; Paquet and Robidoux, 2001). Low labour utilisation rate seems pernicious in socialist economies because they were characterised by disguised unemployment. While Yugoslavia is unique among the socialist economies in the sense it was characterised by open unemployment, disguised unemployment was still an acute issue (Mencinger, 1988). This is derived from the nature of a labour-managed economy. Labour held to an extent traditional managerial prerogatives. When faced with cost-cutting requirements, workers were presumably reluctant to dismiss themselves or their colleagues.

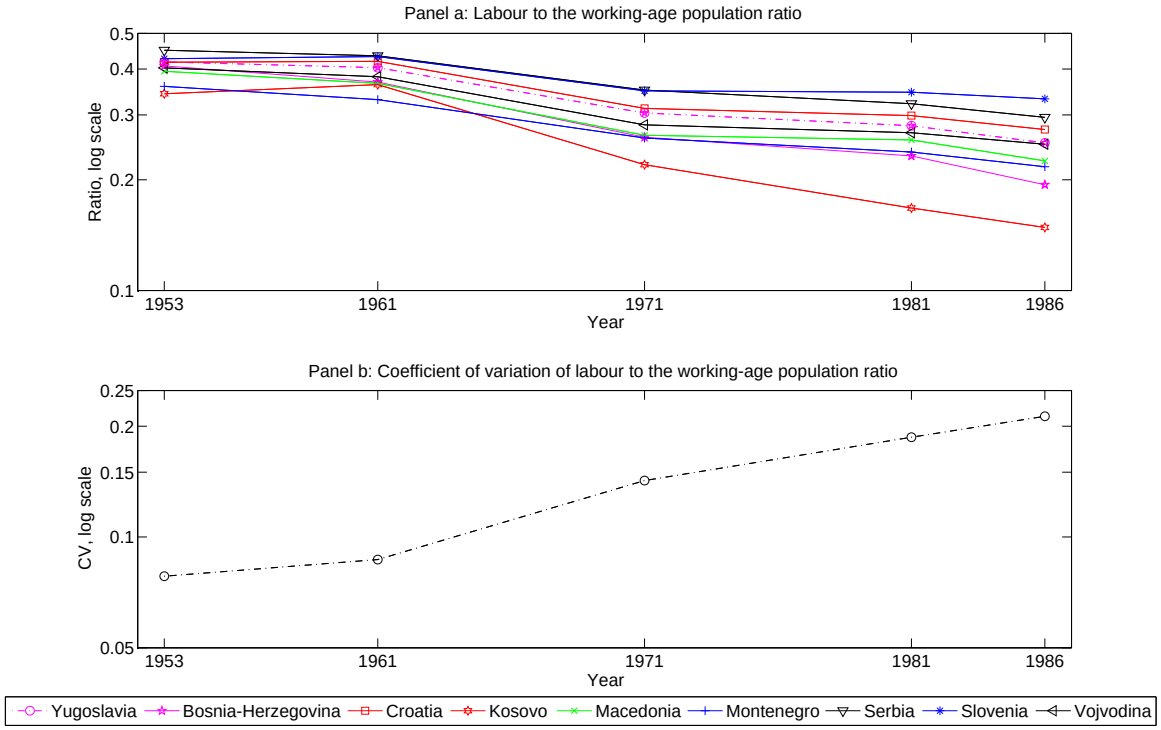
It is impossible to directly observe labour utilisation rate, particularly real effort. As such, existing (business cycle) research typically measures labour utilisation by dividing labour by the working-age population (Burnside, Eichenbaum, and Rebelo, 1993). I follow the example in figure 7. The figure suggests that labour utilisation rate has consistently decreased across the regions (panel a). However, labour utilisation rate has decreased more in the LDRs (reflected in increasing CV in panel b of figure 7), suggesting that the LDRs suffered more from declining labour utilisation than the MDRs did. By extension, the evolution of TFP in the LDRs was retarded relative to the evolution of TFP among the MDRs.

Second, the capital intensity was debilitating in the LDRs because they were characterised by labour abundance. Capital intensity bias skewed production away from the usage of the relatively abundant factor of production, i.e. labour. This likely caused inefficiency in the LDRs, which should be reflected in the divergence of regional TFPs.

Is the hypothesised relationship between the capital intensity bias, employment rate, and

ployment rates in the LDRs are themselves supportive of the hypothesis that the LDRs were particularly afflicted by the capital intensity bias.

Figure 7: Labour to the working-age population ratio, 1953-86



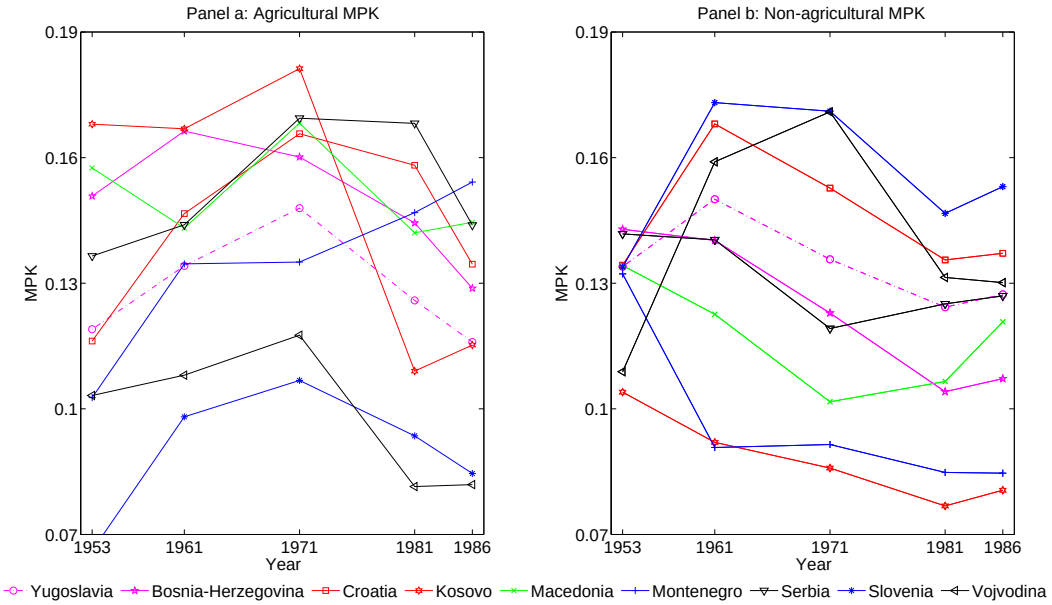
Notes: Labour is total hours worked. As in business cycle research, annual labour (total hours worked) is de-trended by 3600 hours. People spend a portion of time satisfying biological necessities (like sleeping), and can not work. Otherwise, panel b is similar to figure 3.

TFP, explicitly visible in the data? MPK should encapsulate these relationships. It may seem obvious that regional MPKs must have strongly converged given the strong convergence in capital to labour ratios. However, as Lucas (1990) points in a seminal article, poor regions might have lower endowments of factors complementary to physical capital and lower TFP.[27] Strong convergence in capital to labour ratios might thus coexist with large differences in the MPK. This implies that inputs are inefficiently used (Caselli and Feyrer, 2007).

In particular, if the capital intensity bias retarded the evolution of employment rate and TFP in the LDRs relative to the MDRs, one would expect that the LDRs had a lower MPK than the MDRs did in non-agriculture, but not necessarily in agriculture. Non-agriculture was characterised by a much larger fraction of labour-managed firms than agriculture was. Agriculture largely consisted of private, profit-maximising, firms, unaffected by the capital-intensity bias.

[27] Lucas (1990) also lays out the option that international capital markets are distorted, mitigating the flow of capital from rich to poor countries. In Yugoslavia, labour-managed firms, next to other factors, distorted the capital market. Capital market did not exist in a meaningful sense. If capital market operated in Yugoslavia, capital would have flown from poor to rich regions, given that the richer regions were typically characterised by a higher MPK (figure 8). The experience of Yugoslavia can be perceived as a twist to the proposition of Lucas (1990).

Figure 8: Evolution of MPK, 1953-86



Indeed, perversely enough, panel b in figure 8 shows that since 1961 non-agricultural MPK among the MDRs was systematically higher than non-agricultural MPK among the LDRs. Regional differences in the evolution of non-agricultural MPK are striking. Among the MDRs, non-agricultural MPK has increased over the whole sample period, while non-agricultural MPK among the LDRs has decreased over the whole sample. In agriculture, the trends are different. As one would normally expect, the poorer regions had a higher level of MPK than the richer regions (Slovenia and Vojvodina), with the notable exception of Croatia.

Furthermore, table 4 demonstrates that there is no evidence of a negative correlation between labour productivity and the MPK in non-agriculture. The correlations are, perversely, positive, indicating gross inefficiency in the LDRs.[28] Furthermore, the correlations have increased over time (implied by figure 8). In agriculture, where labour-managed firms were not as concentrated, the correlations are negative as one would normally expect given the predictions of the Solow growth model.

In the long-run, such perverse relationships would diminish or disappear. Labour would move to firms, or establish firms, where it could realise a higher marginal product, arbitraging productivity differentials. Alternatively, labour could move to regions where it could realise a higher marginal product, diminishing productivity differentials. These forces are conditional on free entry of labour into existing firms, free establishment of new firms, and interregional labour

[28]Similar to physical capital, there was a strong positive correlation between the marginal product of human capital and labour productivity. Over the set of five benchmark years, the correlation was larger than 0.9.

Table 4: Correlation between labour productivity and the marginal product of physical capital (MPK), 1953-86

	Non-agriculture	Agriculture
1953	0.66	-0.51
1961	0.72	-0.91
1971	0.79	-0.70
1981	0.91	-0.73
1986	0.87	-0.56

mobility. All three conditions did not hold in Yugoslavia.[29]

Entry of workers into firms was not free. Existing workers of labour-managed firms were discouraged from employing new workers. They would have to share income within a larger group, diluting their wages due to declining marginal product of labour. This behaviour resembles insider-outsider models of labour markets characterised by strong trade unions.

The tendency of labour-managed firms to restrict employment is theoretically well grounded (Ward, 1958; Meade, 1972). Free establishment of firms could have alleviated this distortion. Entry of firms was not free though. Local government decided whether to allow an establishment of a firm within its administrative boundaries (Horvat, 1971). Furthermore, labour had poor incentive to create new firms since these had to be socially owned Estrin (1991).

Yugoslav interregional migration was low compared to the OECD countries (5). Low interregional labour mobility was caused by three factors. First, low interregional labour mobility was, of course, itself a symptom of intrinsic barriers to new labour entry into existing labour-managed firms.

Second, the incentive to migrate from poorer to richer regions was additionally distorted because the interregional differences in wages were compressed for egalitarian reasons, and therefore did not fully reflect interregional differences in productivity. Given their marginal products, labour in the LDRs earned higher wages than labour in the MDRs, distorting their incentive to move to richer regions and thus arbitrage productivity differentials. Figure 9 demonstrates this. Labour in all regions earned lower wages than labour in Slovenia, the productivity leader (panel a of figure 9). However, regional differences in the wage rate should have been higher given the regional differences in the marginal product of human capital (MPH). Panel b in figure 9 shows that the return to human capital was typically more detached from its marginal product in the LDRs than it was in the MDRs. That is, labour augmented by quality earned a wage that was

[29]Of course, capital could have arbitraged productivity differentials, too. But, private interregional capital flows were effectively banned for reasons espoused in section 2.

Table 5: Interregional migration in Yugoslavia and a selected group of OECD countries (migrants as percent of total population)

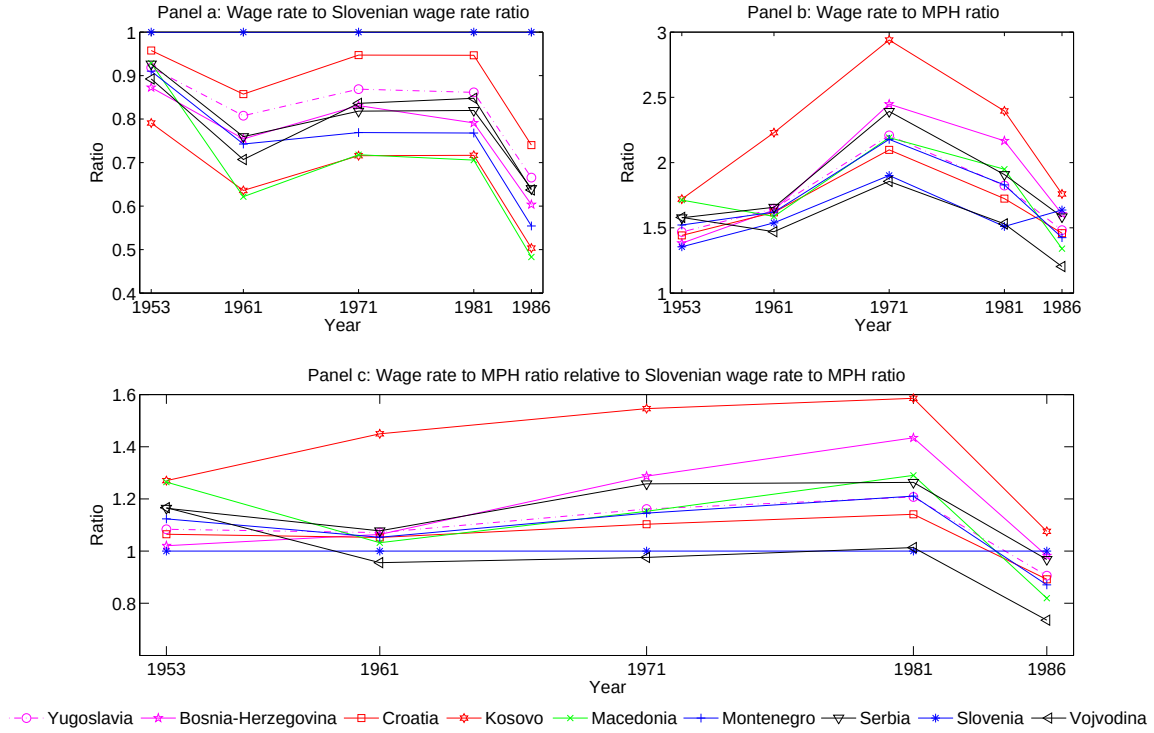
Yugoslavia (1989)	0.25
Bosnia-Herzegovina	0.5
Croatia	0.17
Kosovo	0.19
Macedonia	0.12
Montenegro	0.43
Slovenia	0.18
Vojvodina	0.26
Selected OECD countries (1987)	2
Australia	1.6
Canada	1.5
Finland	1.6
France	1.3
Germany	1.1
Italy	0.5
Japan	2.6
Norway	2.6
Sweden	3.9
United States	2.8

Notes: Serbia is not reported in the used source. OECD average is unweighted.
Source: Cviki, Kraft, and Vodopivec (1993).

higher than implied by its marginal product in all regions, but typically more so in the LDRs. Moreover, it seems that the incentive to migrate from poorer to richer regions has deteriorated over time. This is implied by panel c in figure 9; the wage rate to MPH ratio has typically increased in the LDRs relative to the same ratio in Slovenia until 1981.

Third, with the elimination of travel restrictions during the mid-1960s, approximately 10 per cent of the Yugoslav labour force migrated to Western Europe - primarily to (western) Germany as "guest workers" (Lampe, 2000). Arguably, when faced with a choice of whether to migrate to Yugoslav another region or another Western European country, a prospective Yugoslav migrant opted for the latter. She could seize higher pecuniary benefits abroad. Strong cultural differences among the Yugoslav regions certainly lowered the relative physic costs of migrating to another western European country, as opposed to migrating to another Yugoslav region.

Figure 9: Wage rate and the marginal product of human capital (MPH), 1953-86



Notes: Wage rate is hourly wage. Human capital is labour augmented by quality.

8 Conclusion

Yugoslavia is often perceived as a unique success story among the socialist economies, exhibiting rapid catch-up growth until the late 1970s (Balassa and Bertrand, 1970; Sapir, 1980). But, very little is known about economic development at the regional level both within Yugoslavia and in socialist Europe at large. This paper fills an important gap in the literature on post-war growth in Europe with a detailed quantitative study of regional patterns of growth in Yugoslavia, probably the most heterogeneous country in Europe during the 20th century, besides the Soviet Union.

The falling behind of the least developed regions of Yugoslavia was caused by their inability to converge towards the TFP levels and employment rates of the more developed regions. I interpret these failures as symptoms of a single underlying problem: a capital intensity bias inherent to the governing objective of the labour-managed firms.

Responsibility over regional development was devolved to the regions. Further down the aggregation level, control over production, marketing, and investment, was devolved to the labour-managed firms. Socialist Yugoslavia moved from having one central plan, to having many mutually competitive plans. While on aggregate this may have created a net positive

productivity outcome, witnessed by Yugoslavia's impressive productivity performance compared to other socialist economies, it created unique distortions. The decentralisation policies were implemented with the aim of stimulating regional equalisation of incomes and maintaining social stability. They led, however, to exactly opposite outcomes.

A Appendix

A.1 Data

A.1.1 Output

SP is the conceptual equivalent of GDP in the sense that SP, just like GDP, measures the value of all final goods produced domestically. SP and GDP are, however, calculated differently and yield different levels of output. Even though they are conceptual equivalents, they are only approximately comparable. SP was calculated only for the "productive sector". The "non-productive sector" that was excluded from SP consisted of a section of services, primarily non-market services - government administration, defence, healthcare, education, culture, and housing.

Over time, productive segments of the non-productive sector were incorporated into the SP. For example, publishing activity which was part of the education sector was added to the SP. However, the Yugoslav statistical bureau, *Savezni Zavod za Statistiku* (SZS), did not estimate the output of such (minor) sub-sectors for the whole period. In effect, when SZS expanded coverage of the SP, it concluded that all of the newly discovered value-added occurred in the year in which the new sub-sector was incorporated into the SP, magnifying the growth rate of output rate at the moment of inclusion of a new sub-sector.

A more troublesome feature of the Yugoslav version of national accounts is its inconsistency in the application of the *Material Planning System*, the socialist equivalent of the *System of National Accounts*. In Yugoslavia, as in all internally consistent national accounts, the reported output by value-added and the reported output by expenditure yield the same level. But, on closer inspection, it is conceptually impossible that the two would yield the same level of output. Output by value-added excluded the non-productive sector, while output by expenditure included gross investment incurred in the non-productive sector.

Furthermore, SP was calculated by subtracting from gross production of the productive sector only the "material" or "productive" costs, including depreciation, while the inputs from the excluded service sectors were not subtracted. So, as Alton, Badach, Bass, Bakondi, Brumaru, Bombelles, Lazarcik, and Staller (1992) (pp. 6-7) argue, SP was not a "clean" value-added measure.

On net, the aforementioned statistical peculiarities of SP yield a lower level of output than GDP. Miljković (1992), working within SZS on Yugoslavia's internationally comparable GDP during 1985-1991 as part of the European Comparison Programme funded by the UN and the World Bank, provides the most systematic quantitative comparison between GDP and SP levels. For the 1985 benchmark year, he finds that SP provides a 11.6 per cent lower level of output than GDP.

Irrespective of SP underestimating the level of output, Yugoslavia was alongside other socialist countries criticised by Western scholars that it overestimated the growth rate of output (see Ofer (1987) for a literature survey). To elaborate some of the issues reported in section 5, SZS, for instance, used the Paasche index to deflate industrial production. Staller (1986) argues that this index underestimates inflation in Yugoslavia, hence overestimating real economic growth. He reports that SZS, upon introducing new or changed products into the index of industrial production, used prices prevailing in the second year of production which still reflected costs of development. As such products were typically rapidly growing, the greater weight they were assigned by prices of the initial period inflated the growth rate of total industrial production.

Socialist countries also distorted the value of industrial and agricultural production. Prices were distorted by setting the prices of industrial goods above world prices, while prices of agricultural goods were set below world prices. The intention of socialist planners was to change the terms of trade between the two sectors which would be conducive to the development of industry. This development strategy was formulated in the early years of the Soviet Union by Yevgeni

Preobrazhensky. It was based on the concept of "primitive socialist accumulation". Primitive socialist accumulation creates three statistical biases. First, economic growth is overestimated since the rapidly growing manufacturing output is assigned a greater share in total output than it corresponds to the actual state. Second, price distortions overestimate the marginal product of industry and underestimate the marginal product of agriculture. By extension, price distortions also overestimate the efficiency gains associated with structural modernisation as estimated in this paper. Finally, as discussed in section 5, price distortions bias the evolution of regional inequality. The final issue was explicitly recognised by Yugoslav statisticians. In 1954, in SZS's *Metodološki Materijali, Broj 61: Metodologija za Obračun Narodnog Dohotka* (Savezni Zavod za Statistiku (1955), pp. 22-23) (methodological materials), the head of SZS wrote:

"As a consequence of a certain economic policy, prices of our industrial goods are above global market prices, and prices of agricultural goods are below this average... We cannot know the true contribution of industry and agriculture to income of the country, as long as we do not eliminate differences in levels of prices... this is inevitably reflected in income of each republic, due to differences in their economic structures. Industrially more developed republics are contributing to the income of the country with a greater share than it corresponds to the actual state."[30]

The most recent rendition of the Maddison Project in Bolt and van Zanden (2014) includes the GDP series of Yugoslav successor states made by Branko Milanović. His aim was to produce internationally comparable long-run GDP levels of the successor states of Yugoslavia. He has used the World Bank's GDP estimate of Slovenia in 1990 as an anchor to estimate the GDP of the other Yugoslav regions. He has anchored Yugoslav regions around the Slovenian 1990 GDP level by their 1990 income differences estimated by the SZS. Subsequently, he has projected their historical growth rates using official data (information obtained through personal correspondence). Thus, even though Milanović has made more realistic output levels of Yugoslav regions compared to SZS, regional inequality remains plausibly problematic, and regional economic growth rates remain overestimated.

As such, I re-estimate the GDP series of Yugoslav regions. As mentioned in section 5, official data might bias the level and evolution of regional income inequality through price distortions and through excluding non-market services from the estimate of output. I eliminate these two possible distortions in two steps.

In the first step, I apply international prices to the agricultural and non-agricultural sectors of Yugoslav regions. I therefore eliminate price distortions that might bias the level and evolution of regional income inequality. More formally, I multiply the official share of a region's sectoral SP in the total sectoral SP by the total sectoral GDP estimated by the Research Project.[31] Thus:

$$Y_i = Y_{YUG,A,RP} * \frac{Y_{i,A,SZS}}{Y_{YUG,A,SZS}} + Y_{YUG,NA,RP} * \frac{Y_{i,NA,SZS}}{Y_{YUG,NA,SZS}} \tag{18}$$

where aggregate output (Y) of region i is a sum of output derived from agriculture (A) and non-agriculture (NA).[32] Subscripts SZS and RP denote sources of data. RP means that data is taken from the Research Project. SZS denotes official data. In equation 18, I assume that a region's share in the total A and NA SP is the same as its share in the total Yugoslav (YUG) A and NA GDP. Since I anchor regional A and NA output by the A and NA GDP of Yugoslavia estimated by the Research Project, I allow each region a different size of A and NA output compared to official data. But, I keep the share of each region in the A and NA output of Yugoslavia

[30] Translated by the author.

[31] Official output data is taken from *Jugoslavija 1918-1988: Statistički Godišnjak* (Savezni Zavod za Statistiku, 1989) and *Statistički Godišnjak SFR Jugoslavije* (Savezni Zavod za Statistiku, 1991)). Alternative aggregate GDP of Yugoslavia is taken from Maddison (online). He has used the the Research Project's GDP estimates of Yugoslavia, and expressed them in 1990 Int. GK$. Alternative Yugoslav GDP sectoral data is taken from the publications of the Research Project, because they are not reported by Maddison (online) - Alton (1970) and Alton, Badach, Bass, Bakondi, Brumaru, Bombelles, Lazarcik, and Staller (1992).

[32] To reduce notational clutter, I ignore a subscript for time.

identical to official data. In other words, I keep the value of Yugoslavia's aggregate and sector-specific GDP as estimated by the Research Project, but provide new regional GDPs. Since the Research Project used international prices (US dollars) to estimate the GDP of Yugoslavia's agricultural and non-agricultural sector, equation 18 allows me to eliminate price distortions between agriculture and non-agriculture that might bias regional inequality. By this method, however, I can not eliminate price distortions operating within agriculture and non-agriculture, if they were present. I can only eliminate price distortions between broadly conceived agriculture and non-agriculture.

In the second step, I eliminate possible distortions caused by the non-market services that were excluded from the SP. The MDRs were likely characterised by a larger share of non-market services in the their NA output than the LDRs were, which SZS does not account for. In other words, a region's share in the total NA SP was certainly not the same as its share in the total NA GDP. In the second step, I adjust for non-market services by dividing NA into two parts - the productive (PNA) and the non-productive ($NPNA$) part (non-market services) of non-agriculture. For PNA, just like in the first step, I multiply the official share of a region's PNA SP in the total PNA SP by the total PNA GDP of Yugoslavia estimated by the Research Project. Like in the first step, I assume that a region's share in the productive part of the non-agricultural SP is the same as its share in the total productive part of non-agricultural GDP.

For the non-productive sector, or non-market services, I take a different approach. I impute regional $NPNA$ GDP levels through factor cost. This is consistent with the methodology of the Research Project. The Research Project used the method of Bergson (1953) to estimate Soviet national income at factor cost. They relied on official sectoral volumes of factors of production that they transformed into sectoral GDP by estimating the returns to factors of production.

More explicitly, I estimate the share of a region's $NPNA$ wage bill (W) in the total $NPNA$ wage bill. Then, I multiply the share of a region's $NPNA$ wage bill (W) in the total $NPNA$ wage bill by the Yugoslav $NPNA$ GDP estimated by the Research Project. Thus, I decompose the second term in equation 18 as follows:

$$Y_{YUG,NA,RP}*\frac{Y_{i,NA,SZS}}{Y_{YUG,NA,SZS}} = Y_{YUG,PNA,RP}*\frac{Y_{i,PNA,SZS}}{Y_{YUG,PNA,SZS}}+Y_{YUG,NPNA,RP}*\frac{W_{i,NPNA,SZS}}{W_{YUG,NPNA,SZS}} \tag{19}$$

Note that I do not adjust for capital income. It is impossible to estimate capital returns by region. Importantly, it is not possible to estimate the imputed rent of housing, which is by far the most significant category of the aggregate capital stock of non-market services. Most importantly, it is not possible to account for cross-regional subsidisation of capital.

Estimating GDP through factor cost involves adding taxes and subtracting subsidies. This can be difficult to do at a regional level. In case of Yugoslavia, the workers in the MDRs were subsidising the wages of workers in the LDRs. The Federal Fund that channeled capital to the LDRs was financed through taxing the income of firms in the MDRs. This is reflected in the wages of workers employed in the labour-managed firms. Vanek and Jovičić (1975) argue that workers of labour-managed firms were appropriating capital income. By extension, workers in the LDRs appropriated more capital income than they would have been able in the absence of capital transfers, given their marginal products. If interregional taxation and subsidisation is unaccounted for, GDP measured through factor cost will underestimate the output levels of MDRs. I attempt to account for interregional taxation and subsidisation by using 1990 wage data.[33] By 1990, the Yugoslav market disintegrated (Lampe, 2000). The MDRs stopped paying taxes to the federation, and the Federal Fund dissolved. By extension, the workers in the MDRs stopped subsidising the workers in the LDRs, and the relative wages of workers in the LDRs strongly decreased. Thus, 1990 wages should reflect implicit interregional taxation and

[33] *Statistički Godišnjak SFR Jugoslavije* (Savezni Zavod za Statistiku, 1991)

Table 6: Compound annual growth rate of real output, 1952-89, in %

	Official	Alternative data, accounting for:			
		Price distortions		Price distortions and non-market services	
		Alternative	Comparison, fraction	Alternative	Comparison, fraction
Yugoslavia	5.11	4.75	0.93	4.75	0.93
Bosnia-Herzegovina	4.70	4.33	0.92	4.55	0.97
Croatia	4.95	4.58	0.92	4.59	0.93
Kosovo	5.17	4.84	0.94	5.11	0.99
Macedonia	5.38	5.03	0.94	4.96	0.92
Montenegro	5.06	4.71	0.93	4.55	0.90
Serbia	5.12	4.76	0.93	4.68	0.91
Slovenia	5.33	4.94	0.93	4.97	0.93
Vojvodina	5.65	5.32	0.94	5.10	0.90

Note: Official data is expressed in 1972 dinars. Alternative data is expressed in 1990 Int. GK$.
Sources: See text.

subsidisation. Alternatively, 1990 wages should at least reflect to a larger extent implicit taxes and subsidies than wages in the earlier years. For example, the ratio of the average Slovenian wage rate in non-market services to the average Kosovar wage rate in non-market services in 1990 was 2.6, while in 1972 for example, the same ratio was 1.5 (*Statistički Godišnjak SFR Jugoslavije* (Savezni Zavod za Statistiku, 1991)).

To finalise this section, I estimate regional GDPs through substituting equation 19 into equation 18:

$$Y_i = Y_{YUG,A,RP*}\frac{Y_{i,A,SZS}}{Y_{YUG,A,SZS}} + Y_{YUG,PNA,RP*}\frac{Y_{i,PNA,SZS}}{Y_{YUG,PNA,SZS}} + Y_{YUG,NPNA,RP*}\frac{W_{i,NPNA,SZS}}{W_{YUG,NPNA,SZS}} \quad (20)$$

Table 6 presents the results. Column 2 presents the results of step 1 (equation 18), that is, if I eliminate price distortions between agriculture and non-agriculture, but do not adjust for non-market services. This exercise decreases GDP growth across Yugoslav regions by a very similar magnitude compared to official estimates (column 3 of table 6). Thus, price distortions do not seem to distort official regional inequality trends significantly.[34] This might be explained by the 1972 prices that government statisticians used to estimate historic real output growth rates.[35] By 1972 the most egregious price distortions were eliminated. Prices were substantially liberalised during the mid 1960s as a requirement for Yugoslavia's 1966 accession into the General Agreement on Tariffs and Trade (Horvat, 1971). When I estimate GDP through equation 20, where I adjust for both price distortions and non-market services, which is the final data I use, then the difference in the decrease of average output growth rate across the regions is larger (final column of table 6). It thus appears that exclusion of non-market services from SP is more problematic than price distortions concerning the evolution of regional inequality as estimated by the SZS.

A.1.2 Inputs

The data on gross investment is the most problematic among the data series required for the analysis. Similar to output, gross investment was likely overestimated because of index number problems, price distortions, and perhaps because of outright fabrication from enterprises. While

[34] I can not isolate through equation 18 the impact of price distortions on relative regional growth trajectories from other biases related to SP, like official indexes overestimating economic growth. Such impacts are reflected jointly with price distortions in column 2 of table 6. In effect, by equation 18, I assume that, index number problems for example, impacted all Yugoslav regions identically, inflating regional growth rates by the same extent.

[35] SZS used 1972 prices until the end of Yugoslavia to project the real evolution of economic data, like GDP, investment, and consumption.

alternative output series have been produced in response to the criticism of official series, there are no existing alternative investment series for Yugoslavia. As such, I embrace official data on investment. But, I make an important adjustment using their own data. As mentioned in section 5, I deduct the gross investment category "other" from total gross investment.

Aggregate physical capital consists of four asset types: residential structures (dwellings), non-residential structures, equipment, and livestock. Non-agricultural capital stock consists of the first three asset types, while agricultural capital stock consists of the last three asset types. I rely on Vinski (1959) to initialise sector-specific asset type. Vinski (1959) relies on an official survey of physical capital stock conducted in 1953 for the productive sector. The contribution of Vinski (1959) lies in estimating the value of dwellings and fixed capital of the non-productive sector (e.g. education, healthcare and culture). Moreover, he has estimated the value of capital stock in private agriculture and in public transport, which the official wealth survey did not cover. For the subsectors of non-agriculture however, Vinski (1959) typically does not offer estimates for each asset type. For example, for manufacturing, he reports the overall value of capital, but does not report the share of equipment and the share of structures in the total value of capital. To impute the value of each asset type in the non-agricultural sector, I multiply the official share of equipment and structures in the total value of capital by the total amount of capital in Vinski (1959).[36] I do this for the value of equipment and non-residential structures only, because Vinski (1959) provides the value of residential structures.

Except for livestock, capital stock categories are extended for the remaining years of the analysis via the perpetual inventory method. I extend the 1953 Vinski (1959) estimate of livestock value by the volume of livestock provided in the *Statistički Godišnjak SFR Jugoslavije* (Savezni Zavod za Statistiku, 1954, 1962, 1972, 1983, 1987). Following international accounting standards, livestock that forms agricultural capital consists of cattle that is not used for slaughter, e.g. for draught power and breeding.

Upon estimating individual time-series of various asset types, I sum them into a single capital stock series. I do this because it is not possible to estimate the share of capital subinputs in output.

Table 7 presents the newly estimated aggregate capital stock series in Yugoslavia. It reveals a significantly higher growth rate of physical capital stock in the LDRs than in the MDRs. Compared to the official data, the growth rate of physical capital is on average 1.4 percentage points lower per annum between 1953 and 1986. There are, however, significant differences among the regions.

The large difference between the official and alternative capital stock growth can be attributed to at least three factors. First, I exclude the gross investment category "other". Second, the coverage of my capital stock data is significantly wider. I include the value of fixed capital of non-market services, public transport, private agriculture and livestock, which the official data does not include. Third, official data measures the gross value of physical capital, while I measure the net value of physical capital.

Agricultural land consists of land used for cultivation of crops, grazing, and forestry. Following international accounting standards, agricultural land excludes assets whose growth is the result of human cultivation, such as orchards, vineyards and timber. I include such assets in non-residential structures. To initialise the value of land, I again rely on Vinski (1959). He estimates the value of agricultural land in 1953 by capitalising land rent. In earlier work, Vinski (1957) estimated the value of agricultural land by prices of freely exchanged land. For Yugoslavia as a whole, Vinski (1959) reports that capitalising land rent yields a 5 per cent higher value of agricultural land than by estimating it through the prices of freely exchanged land. I use his more recent work (Vinski, 1959) because there he estimates the value of agricultural land at a

[36] Official data is taken from *Osnovna Sredstva Privrede Društvenog Sektora SFR Jugoslavije, Socijalističkih Republika i Socijalističkih Autonomnih Pokrajina, 1952-1981, u cenama 1972* (Savezni Zavod za Statistiku, 1983b).

Table 7: Compound annual growth rate of real capital stock, 1953-86, in %

	Official data	Alternative data	Difference
Yugoslavia	6.21	4.81	-1.40
Bosnia-Herzegovina	6.51	5.35	-1.17
Croatia	5.96	4.39	-1.57
Kosovo	7.62	6.02	-1.59
Macedonia	7.11	5.30	-1.81
Montenegro	9.76	5.92	-3.84
Serbia	5.96	4.91	-1.04
Slovenia	5.73	4.45	-1.29
Vojvodina	6.54	4.64	-1.90

Notes: Official data is denoted in 1972 prices. Alternative data is expressed in 1990 Int. GK$.
Sources: Official data is taken from *Statistički Godišnjak SFR Jugoslavije* (Savezni Zavod za Statistiku, 1991). See text for the alternative data.

regional level. In earlier work, Vinski (1957) estimated the value of agricultural land only for Yugoslavia as a whole.

As mentioned in the main text, I extend the Vinski (1959) estimate of the value of agricultural land for the remaining years of the analysis by the evolution of the volume of agricultural land available in official sources.

Moving to labour data, the 1986 headcount of agricultural labour working in private capacity is not reported in official publications. I estimate agricultural labour through a linear interpolation between the 1981 and 1991 census years.

I adjust labour for hours worked. I take effective hours worked which exclude sick leave, vacation leave and maternal leave, but include overtime and similar categories. For non-agriculture, effective hours worked are taken from SZS as reported in section 5. Average hours worked are reported only for Yugoslavia. They are not reported for regions. I estimate regional average hours worked in non-agriculture by their industrial composition. That is, I multiply the ratio of industry-specific regional labour to total regional labour by the industry-specific hours worked in Yugoslavia on average. I then take the summation of this exercise to impute the regional hours worked in non-agriculture. Hours worked in private agriculture are not reported in official publications. I derive these from the work of Gollin, Lagakos, and Waugh (2014). They find that, on an average global scale, agricultural workers tend to work 10 per cent less hours per annum than non-agricultural workers. I assume the same was the case in Yugoslavia.

Table 8 reports labour growth in Yugoslavia. Given the negative expansion of labour, the data implies that labour productivity in Yugoslavia grew faster than aggregate output. This stands in conflict with the common claim that socialist growth was driven by the expansion of capital and labour (Krugman, 1994). Labour input was at best stagnant because of two reasons. First, between 1953 and 1986, the amount of yearly hours an average labourer spent working decreased by approximately 25 per cent. Second, as further elaborated in section 7, a significant fraction of Yugoslav labour moved to Western Europe in search for higher wages, draining the domestic supply of labour.

Average years of schooling that agricultural labour obtained by 1981 and 1986 is not reported in official publications. I estimate average years of schooling of agricultural labour for these two years by assuming that agricultural labour continued converging, but at a linearly decreasing rate, towards the educational attainment of non-agricultural labour. In 1953, average agricultural labourer attained 60 per cent less years of education than an average non-agricultural

Table 8: Growth of labour, 1953-1986, 1953=100

	Headcount	Total hours worked
Yugoslavia	106.1	86.9
Bosnia-Herzegovina	102.9	85.1
Croatia	97.2	80.0
Kosovo	117.6	96.1
Macedonia	116.3	95.4
Montenegro	117.5	98.2
Serbia	108.7	88.4
Slovenia	128.1	104.5
Vojvodina	96.6	78.4

Sources: See text.

labourer. By 1971, the gap decreased to 52 per cent. I assume that by 1986 the average sectoral gap in educational attainment decreased further to 46 per cent. I estimate these gaps at a region-specific level.

A.1.3 Factor shares

For the purpose of measuring income shares, value added is measured from the perspective of the producer. This involves removing indirect taxes on the value of output (e.g. sales taxes). Labour compensation includes all wages, salaries, supplements and employer contributions towards social insurance. Agricultural labour compensation also includes the value of natural consumption, i.e. the value of agricultural products produced and consumed at farm. Assuming constant returns to scale, capital share in non-agriculture is calculated as one minus the estimated labour share. In agriculture, capital share is estimated as one minus the estimated labour and land shares.

As mentioned in section 5, I estimate aggregate factor compensation as a weighted average of agricultural and non-agricultural factor compensation. Since I find that the labour share in agriculture and non-agriculture is identical (0.57), aggregate labour share is also the same (0.57). For capital this is not the case, while land is employed only in agriculture. More formally, I thus estimate aggregate capital and land share as:

$$\kappa = s\beta + (1 - s)\alpha \tag{21}$$

$$\rho = s\gamma \tag{22}$$

where, as before, κ is the capital share of aggregate output, β is the capital share of agricultural output, α is the capital share of non-agricultural output, ρ is the land share of aggregate output, γ is the land share of agricultural output, and s is agricultural share of aggregate output.

A.2 Regional inequality measures

The Gini coefficient, G, is defined as:

$$G = \frac{1}{\bar{y}} \frac{1}{n(n-1)} \sum_{i}^{n} \sum_{j}^{n} [y_i - y_j] \tag{23}$$

where y_i and y_j denote output per capita of observation i and observation j, respectively. n denotes the amount of observations, and $\bar{y}$ is the unweighted mean output per capita.

The coefficient of variation, CV, is defined as:

$$CV = \frac{\sigma}{\mu} \tag{24}$$

where σ denotes standard deviation, and μ is mean.

The Theil index, T, is defined as:

$$T = \frac{1}{n}\sum_{i=1}^{n} \frac{y_i}{\bar{y}} ln\left(\frac{y_i}{\bar{y}}\right) \tag{25}$$

where y_i denotes output per unit of observation i, $\bar{y}$ is the unweighted mean output per unit of n amount of observations.

A.3 Vollrath (2009) dual economy model

A.3.1 Overview and existing literature

The main advantage of the Vollrath (2009) dual economy model is that it explicitly analyses the marginal product gap between agriculture and non-agriculture. By doing so, the model acknowledges potential distortions that might hamper the reallocation of resources between sectors. In turn, elimination of these distortions decreases the sectoral marginal product gap, yielding efficiency gains as inputs migrate to a more productive use.

The existing literature has, broadly speaking, followed two approaches in estimating the gains associated with structural modernisation. The first employs some variant of regressing output on an indicator of agricultural (over)employment (e.g. Temin (2002)). The second strategy involves choosing a functional form for the relationship between output and structural modernisation (Stiroh, 2002). Within this approach, at least in economic history research, shift-share analysis is widely used (Broadberry, 1998; Timmer and de Vries, 2009).

Both strands of research typically rely on unrealistic identification assumptions. Such research typically does not make a distinction between average and marginal products, or either implicitly or explicitly assume that the change in sectoral marginal product gap mirrors the change in the sectoral average product gap. This is misleading, because an average product gap can indicate efficiency, rather than inefficiency. Productivity gains stemming from a better allocation of resources can be brought about only through a narrowing of the difference in the marginal product gap between sectors, not due to a narrowing of the difference in their average products (Herrendorf, Rogerson, and Valentinyi, 2014).

A.3.2 The model

The aim of dividing the economy into two parts is to identify reallocation gains associated with a transfer of factors from agriculture to non-agriculture. Stated and subsequent assumptions about production functions and technological parameters serve to identify and then to remove the sectoral gap in marginal products of physical and human capital. With these aims in sight, equations 2 and 3 in the main text can be expressed in per worker terms by dividing them by aggregate labour:

$$\frac{Y_a}{L} = A_a \left(\frac{R}{L}\right)^{\gamma} \left(\frac{K}{L}\right)^{\beta} \left(\frac{(hL)}{L}\right)^{1-\gamma-\beta} k_a^{\beta} q_a^{1-\gamma-\beta} \tag{26}$$

$$\frac{Y_{na}}{L} = A_{na} \left(\frac{K}{L}\right)^{\alpha} \left(\frac{(hL)}{L}\right)^{1-\alpha} (1-k_a)^{\alpha} (1-q_a)^{1-\alpha} \tag{27}$$

where k_a is the share of total physical capital employed in agriculture, and q_a is the share of total human capital employed in agriculture. Note that equations 26 and 27 concern themselves with the share of human capital employed in agriculture ,$(hL)_a/(hL)_t$, rather than the share of labour engaged in agriculture, L_a/L_t. It is important to stress this distinction because the gap in the sectoral marginal product of labour may not reflect inefficiency if agriculture and non-agriculture differ in endowments of human capital (Vollrath, 2009).

With sector-specific production functions established, the static problem is to calculate a hypothetical aggregate level of income per worker, y^*, that is maximised over the share of physical and human capital employed in agriculture, $y^* = \max_{k_a q_a}(y)$. Given equations 26 and 27, the identity $y^* = \max_{k_a q_a}(y)$ can be expanded into:

$$y^* = \max_{k_a q_a}[\Omega_a k_a^{\beta} q_a^{1-\gamma-\beta} + \Omega_{na} (1-k_a)^{\alpha} (1-q_a)^{1-\alpha}] \tag{28}$$

where for notational simplicity:

$$\Omega_a = A_a \left(\frac{R}{L}\right)^{\gamma} \left(\frac{K}{L}\right)^{\beta} \left(\frac{(hL)}{L}\right)^{1-\gamma-\beta} \tag{29}$$

and:

$$\Omega_{na} = A_{na} \left(\frac{K}{L}\right)^{\alpha} \left(\frac{(hL)}{L}\right)^{1-\alpha} \tag{30}$$

First order conditions of equation 28 require identical marginal productivity of human and physical capital in agriculture and non-agriculture. Differentiating sector specific output with respect to human capital employment share in both sectors yields:

$$(1-\gamma-\beta)\Omega_a k_a^{\beta} q_a^{-\gamma-\beta} = (1-\alpha)\Omega_{na} (1-k_a)^{\alpha} (1-q_a)^{-\alpha} \tag{31}$$

For physical capital:

$$\beta\Omega_a k_a^{\beta-1} q_a^{1-\gamma-\beta} = \alpha\Omega_{na} (1-k_a)^{\alpha-1} (1-q_a)^{1-\alpha} \tag{32}$$

Assuming that $1-\alpha-\beta$ is equal to $1-\alpha$, i.e. that the labour share of output is identical in the two sectors, equation 31 can be solved for the share of human capital engaged in agriculture that maximises aggregate income per worker, q_a^*:

$$q_a^* = \frac{1}{1 - \left(\frac{\Omega_{na}(1-k_a)^{\alpha}}{\Omega_a k_a^{\beta}}\right)^{\frac{1}{\alpha}}} \tag{33}$$

Any increase in non-agricultural TFP to agricultural TFP (embedded respectively in Ω_{na} and Ω_a) implies a shift of human capital out of agriculture. The same holds for the employment share of physical capital. Furthermore, and more implicit, under the assumption that α (non-agricultural physical capital share) is greater than β (agricultural physical capital share), any increase in aggregate physical capital stock implies a shift of human capital out of agriculture.

The income maximising share of physical capital employed in agriculture, k_a^*, is found by substituting equation 33 into equation 32:

$$k_a^* = \left(\frac{\beta}{\alpha}\right)^{\frac{\alpha}{\alpha-\beta}} \left(\frac{\Omega_a}{\Omega_{na}}\right)^{\frac{1}{\alpha-\beta}} \tag{34}$$

Holding factor shares constant, income maximising share of physical capital employed in agriculture depends on the ratio of, broadly conceived, agricultural to non-agricultural productivity

(Ω_a and Ω_{na}). Given factor shares, equation 28 can now be solved to obtain the potential income per worker in each region at each point in time, holding constant the aggregate levels of human and physical capital, the value of land, and sector-specific TFP's.

A.4 Robustness checks

In this section, I test the sensitivity of my baseline results. Namely, that 1) MDRs experienced higher TFP growth rates than the LDRs, and that 2) TFP gradually accounted for a larger fraction of income differences in Yugoslavia. The baseline results remain qualitatively unchanged or similar to alternative technological parameters, depreciation rates, returns to years of schooling, and data. But, of course, the exact quantitative significance of results changes. I also provide a descriptive analysis of how the assumption of unit elasticity of factor substitution, constant returns to scale, and other assumptions related to the estimation of reallocation gains, might affect my baseline findings.

A.4.1 Alternative labour shares

The assumption of perfectly competitive markets is rigid for a socialist economy. Yugoslavia was certainly characterised by markets that were imperfectly competitive. As such, factor shares do not necessarily reflect the elasticity of output with respect to each input. The technological parameters might be mismeasured. In particular, to the extent that monopoly profits are reflected in capital income, the elasticity of output with respect to capital will be overestimated. In regards to labour, to the extent that socialist regimes suppressed wages to fund investment, the elasticity of output with respect to labour will be underestimated.

The elasticity of output with respect to each input serves as weight. The larger the elasticity on, say, human capital, the larger will be the impact of human capital on the growth rate and level of output. Under constant returns to scale however, these elasticities sum to one. Increasing the explanatory power of human capital also means lowering the explanatory power of physical capital and land. Given that in Yugoslavia human capital grew slower than physical capital, one would expect that increasing the elasticity of output with respect to human capital at the expense of physical capital would increase the importance of TFP in accounting for the differences in the growth rate and the level of output.

Here, I test the sensitivity of my results to the elasticity on human capital. I find that changing the elasticity on human capital uniformly across regions keeps my baseline findings qualitatively identical.[37] I therefore prefer to present here a much more aggressive robustness check which is designed to go strongly against my baseline findings. From the benchmark level of 0.57 for the aggregate economy, I increase the elasticity of output with respect to human capital in the LDRs and Serbia to an upper bound of plausibility of 0.67.[38] I decrease the same elasticity in the MDRs to a lower bound of plausibility of 0.47. The difference in the elasticity on human capital between the two regional groupings is therefore 0.2. Attaching a higher elasticity on human capital in the LDRs serves to increase their TFP growth rates and TFP levels, while attaching a lower elasticity on human capital in the MDRs serves to decrease their TFP growth rates and TFP levels. This exercise should, therefore, substantially reduce the TFP gap between the LDRs and the MDRs.

Before presenting the results of this exercise, it is important to note that is generally conceived that poorer countries tend to have a lower elasticity on human capital than richer countries. But,

[37] I ran two scenarios. From the baseline elasticity on human capital of 0.57 for the aggregate economy, I pushed it first to a lower bound of plausibility of 0.47 - a decrease of 0.10 points. In the second scenario, I pushed the elasticity to an upper bound of plausibility of 0.67, i.e. I increased the elasticity on human capital by 0.10 points compared to the baseline scenario. In both cases, the results are qualitatively identical to the baseline findings.

[38] Increasing the elasticity on human capital in Serbia further goes against my results. It will decrease the fraction of regional productivity differentials that can be attributed to TFP.

Table 9: Sources of growth, 1953-86, in %, average compound annual growth rate

	YUG	BIH	CRO	KOS	MK	ME	SRB	SLO	VOJ	σ^2
Aggregate output	5.02	4.85	4.82	5.39	5.30	5.25	4.90	5.39	5.19	0.05
Aggregate labour	-0.41	-0.49	-0.67	-0.12	-0.15	-0.06	-0.37	0.14	-0.73	0.08
Labour productivity	5.43	5.33	5.49	5.51	5.45	5.31	5.27	5.26	5.92	0.04
Of which:										
Physical capital	1.67	1.87	2.61	1.98	1.76	1.93	1.70	2.26	2.77	0.14
Human capital	1.17	1.49	0.76	1.52	1.34	1.29	1.15	0.54	0.67	0.13
Land	0.02	0.02	0.04	0.01	0.00	0.00	0.02	-0.01	0.05	0.00
Reallocation gains	0.65	0.70	0.36	0.41	0.56	0.76	0.66	0.44	0.00	0.05
TFP	1.92	1.25	1.72	1.59	1.80	1.32	1.75	2.03	2.44	0.13
Percentage of labour productivity growth due to:										
Factors of production	52.72	63.34	62.21	63.74	56.81	60.80	54.38	53.06	58.91	14.51
Reallocation gains	11.90	13.14	6.47	7.46	10.20	14.32	12.43	8.30	-0.03	18.69
TFP	35.38	23.52	31.32	28.80	32.99	24.89	33.19	38.64	41.12	32.83

Notes: YU = Yugoslavia, BIH = Bosnia-Herzegovina, CRO = Croatia, KOS = Kosovo, MK = Macedonia, ME = Montenegro, SRB = Serbia, SLO = Slovenia, VOJ = Vojvodina, and σ^2 = variance.

Table 10: TFP as a source of regional labour productivity level differentials, in %

	(1) Raw TFP	(2) Adjusted TFP
1953	3.8	3.5
1961	67.7	54.7
1971	83.6	73.5
1981	81.1	80.9
1986	72.5	75.4

such conceptions are based on estimations prone to measurement error. Upon accounting for self-employment income, Gollin (2002) finds that labour shares are approximately constant across countries, irrespective of their development levels. Thus, in Yugoslavia, it seems extremely unlikely that there were such larger differences in regional technology parameters as I assume here (0.2). Moreover, if anything, one would expect that MDRs were characterised by a higher elasticity on human capital than the LDRs, contrary to the assumption of this exercise. If so, this would strengthen the baseline findings. Nevertheless, it remains interesting to the test whether the baseline findings remain robust even under assumptions that are arguably implausible.

Tables 9 and 10 show the results when using alternative labour shares. Table 9 recreates the growth accounting exercise of the baseline case depicted in table 2 of the main text. As expected, TFP growth among the LDRs is now higher, while TFP growth among the MDRs is now lower. The baseline result that MDRs experienced a faster growth rate of TFP than the LDRs generally holds. The exception is Croatia, which now has a lower TFP growth rate than Macedonia (and Serbia). The results are therefore quantitatively different to the baseline case, but qualitatively similar.

In table 10 I repeat the development accounting exercise of the baseline case depicted in table 3 of the main text to get a better sense of TFP divergence dynamics. The results are qualitatively similar to the baseline case: TFP accounted for a larger fraction of productivity differentials in Yugoslavia over time. It eventually accounted for more than 70 per cent of the variation in regional productivity levels. However, the importance of raw TFP in accounting for regional differentials now peaks in 1971. It subsequently gradually declines by 1981, and then embarks on a steeper decline until 1986. The importance of adjusted TFP in accounting for the variation in regional productivity levels peaks in 1981. These results are different to the findings

of the baseline case. There, both measures of TFP systematically increased over time, with no reversal of trend. Nevertheless, this robustness check produces results that are qualitatively similar to the baseline case - the importance of TFP in accounting for regional productivity differentials dramatically increased over time. For that matter, in table 10, more dramatically so than in the baseline case.

A.4.2 Alternative depreciation rates

Varying the depreciation rate in the perpetual inventory method changes the relative weight of old and new investment. A higher depreciation rate increases the relative capital stock of regions that experienced a higher investment rate towards the end of the sample period. In Yugoslavia, the LDRs experienced a higher investment rate than the MDRs, converging towards their factor intensities. However, I find that changing depreciation rates uniformly across regions affects my results minimally.[39] For this reason, I rather present here a much more aggressive robustness check. As in the previous robustness check, it is designed to go strongly against my baseline findings. I assign a greater weight to capital stock growth in the MDRs, while assigning a lower weight to capital stock growth in the LDRs. I commensurately increase the relative weight of TFP in the LDRs at the expense of TFP in the MDRs. I increase the depreciation rate in the LDRs and Serbia for each asset type by 50 per cent compared to the baseline case. For the MDRs on the other hand, I decrease the depreciation rate of each asset type by 50 per cent. The LDRs and Serbia therefore have 300 per cent higher depreciation rates than the MDRs in this setting. Before I present the results, note that if I instead gave higher depreciation rates to the MDRs, and lower depreciation rates to the LDRs, this would strengthen my baseline findings.

Tables 11 and 12 show the findings when using alternative depreciation rates. Table 11 recreates the growth accounting exercise of the baseline case depicted in table 2 of the main text. As expected, TFP growth among the LDRs is now higher, while TFP growth among the MDRs is now lower. The results are overall very similar to the previous robustness check. The MDRs generally experienced a faster growth rate of TFP than the LDRs did. As in the previous robustness check where I use alternative labour shares, the exception is Croatia. That region now has a lower TFP growth rate than Macedonia (and Serbia). The results are therefore quantitatively different to the baseline case, but qualitatively reasonably similar.

In table 12 I repeat the development accounting exercise of the baseline case depicted in table 3. The results are qualitatively similar to the baseline case - TFP accounted for a larger fraction of productivity differentials in Yugoslavia over time. However, the importance of TFP is now quantitatively smaller. The importance of raw TFP in accounting for regional differentials peaks in 1971. This finding is identical to the previous robustness check that uses alternative labour shares. The importance of adjusted TFP in accounting for regional productivity differentials peaks in 1971, too. Nevertheless, the importance of TFP in accounting for the variation in productivity differentials increases substantially over time.

A.4.3 Alternative returns to years of schooling

In this section, I assess the sensitivity of my results to returns to years of schooling. Returns to years of schooling effectively serve as a weights on human capital as a source of output in relation to TFP. For example, by assuming higher returns to years of schooling, I would attach a greater weight to human capital as a source of labour productivity growth at the expense of TFP. However, Bevc (1993) finds that returns to years of schooling in Yugoslavia were very similar to returns to years of schooling in other intermediately developed countries in Psacharopoulos (1985), on whose later work Hall and Jones (1999) rely on. Thus, the assumption in the baseline

[39] I ran two scenarios. In the first one, I doubled the depreciation rates. In the second one, I halved the depreciation rates. The results of the baseline case are qualitatively identical. The quantitative results of the baseline development account exercise remain virtually identical.

Table 11: Sources of growth, 1953-86, in %, average compound annual growth rate

	YUG	BIH	CRO	KOS	MK	ME	SRB	SLO	VOJ	σ^2
Aggregate output	5.02	4.85	4.82	5.39	5.30	5.25	4.90	5.39	5.19	0.05
Aggregate output	5.02	4.85	4.82	5.39	5.30	5.25	4.90	5.39	5.19	0.05
Aggregate labour	-0.41	-0.49	-0.67	-0.12	-0.15	-0.06	-0.37	0.14	-0.73	0.08
Labour productivity	5.43	5.33	5.49	5.51	5.45	5.31	5.27	5.26	5.92	0.04
Of which:										
Physical capital	2.24	2.25	2.38	2.40	2.08	2.31	2.01	2.10	2.55	0.03
Human capital	0.99	1.26	0.92	1.29	1.14	1.10	0.98	0.65	0.81	0.04
Land	0.02	0.03	0.04	0.02	0.00	0.01	0.02	-0.01	0.04	0.00
Reallocation gains	0.48	0.52	0.49	0.26	0.39	0.49	0.49	0.55	-0.01	0.03
TFP	1.68	1.27	1.66	1.54	1.84	1.40	1.77	1.97	2.53	0.13
Percentage of labour productivity growth due to:										
Factors of production	60.10	66.46	60.86	67.30	59.00	64.38	57.20	52.19	57.45	23.53
Reallocation gains	8.85	9.71	8.84	4.81	7.22	9.31	9.31	10.37	-0.10	10.82
TFP	31.05	23.84	30.29	27.89	33.78	26.32	33.49	37.44	42.65	33.39

Notes: YU = Yugoslavia, BIH = Bosnia-Herzegovina, CRO = Croatia, KOS = Kosovo, MK = Macedonia, ME = Montenegro, SRB = Serbia, SLO = Slovenia, VOJ = Vojvodina, and σ^2 = variance.

Table 12: TFP as a source of regional labour productivity level differentials, in %

	(1) Raw TFP	(2) Adjusted TFP
1953	30.6	52.1
1961	59.7	57.6
1971	71.0	69.7
1981	66.7	67.9
1986	58.9	63.5

setting that returns to years of schooling in Yugoslavia were identical to those in Hall and Jones (1999) is a reasonable approximation. Nevertheless, it remains interesting to assess the sensitivity of my baseline results to returns to years of schooling. Similar to previous robustness checks, I find that either increasing or decreasing the returns to years of schooling uniformly across regions affects my results minimally. As in the previous robustness checks, I therefore present here a more aggressive robustness check which is designed to go against my baseline findings. I increase the returns to years of schooling in the MDRs at each level of educational attainment by 20 per cent compared to the baseline levels. In the LDRs and Serbia, I decrease the returns to years of schooling at each level of educational attainment by 20 per cent compared to the baseline setting. The LDRs therefore have a 50 per cent lower returns to years of schooling than the MDRs. By this setting, I increase the relative weight of TFP in the LDRs at the expense of TFP in the MDRs.

Before I present the results, note that is is extremely unlikely that the LDRs had lower returns to years of schooling than the MDRs. Bevc (1993) finds that returns to years of schooling in the LDRs were typically higher than in the MDRs. Indeed, this is implied by figure 9 in main text. Wage rate in the LDRs exceeded the MPH to a larger extent than the wage rate in the MDRs. It seems more likely that returns to years of schooling were actually higher in the LDRs. If so, this would strengthen my baseline findings. TFP growth rates and levels in the MDRs would increase relative to TFP growth rates and levels in the LDRs. Nevertheless, it remains interesting to the test whether the baseline findings remain robust even under assumptions that are arguably implausible.

Tables 13 and 14 show the results when using alternative returns to years of schooling.

Table 13: Sources of growth, 1953-86, in %, average compound annual growth rate

	YUG	BIH	CRO	KOS	MK	ME	SRB	SLO	VOJ	σ^2
Aggregate output	5.02	4.85	4.82	5.39	5.30	5.25	4.90	5.39	5.19	0.05
Aggregate labour	-0.41	-0.49	-0.67	-0.12	-0.15	-0.06	-0.37	0.14	-0.73	0.08
Labour productivity	5.43	5.33	5.49	5.51	5.45	5.31	5.27	5.26	5.92	0.04
Of which:										
Physical capital	2.19	2.45	2.11	2.60	2.30	2.53	2.22	1.83	2.24	0.05
Human capital	0.80	1.02	1.10	1.03	0.91	0.88	0.78	0.57	0.74	0.03
Land	0.02	0.03	0.04	0.02	0.00	0.01	0.02	-0.01	0.04	0.00
Reallocation gains	0.56	0.61	0.40	0.33	0.48	0.60	0.57	0.55	0.06	0.03
TFP	1.85	1.24	1.84	1.54	1.76	1.29	1.68	2.32	2.84	0.25
Percentage of labour productivity growth due to:										
Factors of production	55.54	65.44	59.22	66.16	58.96	64.41	57.47	45.42	51.04	46.27
Reallocation gains	10.30	11.36	7.37	5.99	8.74	11.29	10.73	10.44	1.04	10.98
TFP	34.16	23.20	33.41	27.85	32.31	24.30	31.81	44.13	47.92	68.33

Notes: YU = Yugoslavia, BIH = Bosnia-Herzegovina, CRO = Croatia, KOS = Kosovo, MK = Macedonia, ME = Montenegro, SRB = Serbia, SLO = Slovenia, VOJ = Vojvodina, and σ^2 = variance.

Table 14: TFP as a source of regional labour productivity level differentials, in %

	(1) Raw TFP	(2) Adjusted TFP
1953	6.6	23.7
1961	57.1	53.6
1971	68.5	65.8
1981	65.5	67.6
1986	62.2	67.5

Table 13 recreates the growth accounting exercise of the baseline setting depicted in table 2. As expected, TFP growth among the LDRs is now higher, while TFP growth among the MDRs is now lower. But, as in the baseline case, MDRs experienced higher TFP growth rates than the LDRs did. The results are therefore qualitatively identical to the baseline setting.

In table 14 I repeat the development accounting exercise of the baseline case depicted in table 3. The results are qualitatively very similar to the baseline case - TFP accounted for a larger fraction of productivity differentials in Yugoslavia over time. The increase of the explanatory power of TFP in accounting for the variation in labour productivity levels over the benchmark years is larger than in the baseline setting, although the explanatory power of TFP is quantitatively smaller at each measured point in time.

A.4.4 Alternative data: Official output

In this section, I asses the sensitivity of my baseline findings to the GDP data I constructed for this paper. I assess it by using official output data. In order to make the sectoral coverage of capital and labour data identical to that of official output, I subtract the non-productive sectors from the capital and labour data. To the extent that official data overestimates the growth rate of actual output, I expect this exercise to increase the growth rate of output that can be attributed to TFP, given that TFP is estimated as residual growth after accounting for the growth rate of inputs and the reallocation gains. Of course, now the capital and labour data is also different. Potential differences in the findings under this setting and the baseline setting can not be attributed solely to alternative output data. Adjusted capital and labour data impacts the results as well.

Tables 15 and 16 show the findings when using alternative data. Table 15 recreates the

Table 15: Sources of growth, 1953-86, in %, average compound annual growth rate

	YUG	BIH	CRO	KOS	MK	ME	SRB	SLO	VOJ	σ^2
Aggregate output	5.37	5.04	5.17	5.35	5.69	5.72	5.30	5.87	5.51	0.07
Aggregate labour	-0.67	-0.76	-0.95	-0.55	-0.41	-0.36	-0.59	-0.07	-1.02	0.09
Labour productivity	6.04	5.79	6.13	5.90	6.10	6.08	5.89	5.94	6.53	0.05
Of which:										
Physical capital	2.36	2.46	2.27	3.07	2.53	2.90	2.42	1.94	2.59	0.11
Human capital	1.00	1.27	0.94	1.28	1.15	1.13	0.98	0.67	0.82	0.04
Land	0.03	0.04	0.04	0.05	0.01	0.01	0.04	0.01	0.04	0.00
Reallocation gains	0.36	0.49	0.45	0.16	0.32	0.68	0.27	0.50	-0.04	0.04
TFP	2.28	1.54	2.44	1.34	2.10	1.35	2.18	2.82	3.12	0.39
Percentage of labour productivity growth due to:										
Factors of production	56.31	65.02	52.85	74.59	60.39	66.63	58.44	44.06	52.84	79.75
Reallocation gains	5.93	8.46	7.34	2.67	5.18	11.18	4.58	8.44	-0.64	12.30
TFP	37.76	26.52	39.81	22.74	34.43	22.19	36.99	47.51	47.80	91.69

Notes: YU = Yugoslavia, BIH = Bosnia-Herzegovina, CRO = Croatia, KOS = Kosovo, MK = Macedonia, ME = Montenegro, SRB = Serbia, SLO = Slovenia, VOJ = Vojvodina, and σ^2 = variance.

Table 16: TFP as a source of regional labour productivity level differentials, in %

	(1) Raw TFP	(2) Adjusted TFP
1953	11.9	45.0
1961	65.5	63.8
1971	83.8	78.7
1981	77.6	80.5
1986	78.4	81.4

growth accounting exercise of the baseline case depicted in table 2. TFP growth rates are now generally higher, as expected. Kosovo is an exception. Its rate of TFP growth faces is identical to the baseline case. Overall, the findings are very similar to the baseline case. TFP growth was higher among the MDRs than among the LDRs. For growth accounting purposes, official output data therefore does not distort the baseline qualitative findings.

In table 16 I repeat the development accounting exercise of the baseline case depicted in table 3. The results are qualitatively identical to the baseline case - TFP accounted for a larger fraction of the variation in productivity levels over time. The importance of TFP is now quantitatively smaller at each benchmark year, as official data compresses the true extent of the variation in labour productivity levels. However, the initial divergence in TFP levels between 1961 and 1953 is larger in this setting than in the baseline setting.

A.4.5 Other issues

Unit elasticity of substitution between capital and labour The Cobb-Douglas assumption of unit substitution between capital and labour might be wrong. In an seminal paper, Weitzman (1970) argues that the Soviet economy is better represented by constant elasticity of substitution (CES) between capital and labour that is (significantly) below one. Easterly and Fischer (1995) later argue the same using updated data. Sapir (1980) makes the same argument for Yugoslavia.

Elasticity of factor substitution below unity could provide an elegant explanation for both the success and failure episodes of Yugoslavia. An economy characterized by it should run into acute diminishing returns on capital as labour becomes increasingly scarce, leading to a sharp

slowdown in economic growth. Under this line of argumentation, Cobb-Douglas production function overestimates the contribution of capital deepening to growth because it fails to register the true extent of diminishing MPK. It commensurately underestimates the contribution of TFP growth. More explicitly, if Yugoslavia was characterised by CES below one, I underestimate TFP growth. Regionally, TFP growth in the LDRs would be underestimated to a larger extent than TFP growth in the MDRs because the LDRs experienced a faster growth of physical capital.

The above conclusion must be strongly qualified however. It is based on the unlikely assumption of Hicks neutrality of technological change assumed in the CES estimates. If the capital intensity bias mattered, which can be interpreted as a capital using bias in technological change, MPK decline under CES estimates would be mitigated. The estimations would then more closely resemble the findings under the baseline setting that rest on the Cobb-Douglas production function.

Irrespective of these technical considerations, there are, however, at least three reasons that go against the hypothesis that elasticity of factor substitution was lower than one. First, Yugoslavia relied on importing Western technology. This was largely caused by Yugoslavia's isolation from the Soviet Bloc in the late 1940s and the early 1950s. It seems unclear why the country would then face a fundamentally different production function compared to OECD countries, which are largely considered to be characterised by Cobb-Douglas production functions. Second, all Yugoslav regions stagnated in the 1980s, notwithstanding the differences in their economic structures and unemployment levels, or levels of idle labour. Third, the estimation of CES depends on the underlying quality of data. While existing research typically uses revised output data, it relies on official investment. This is problematic. Vonyó (2017) argues that investment data was substantially overestimated by government statisticians, too. The existing research, by relying on official investment data, systematically overestimates the role of capital accumulation. This creates a downward bias in the estimation of elasticity of factor substitution in econometric exercises.

Constant returns to scale The assumption of constant returns to scale might poorly describe agriculture or non-agriculture, or both. The premise of New Economic Geography is based on increasing returns to scale. If, for example, non-agriculture was characterised by increasing returns to scale, perhaps due to externalities among physical and human capital, I would overestimate TFP. TFP would capture externalities brought about by factor accumulation. Conversely, if agriculture was characterised by decreasing returns to scale, the decomposition exercises would underestimate TFP. Nevertheless, the assumption that both agriculture and non-agriculture in Yugoslavia were characterised by constant returns to scale is corroborated by empirical research. Boyd (1987) estimates the Yugoslav agricultural production function. He finds that the elasticity of agricultural output with respect to each input summed to 0.99. Sapir (1980) estimates the Yugoslav manufacturing production function. He finds that the elasticity of manufacturing output with respect to each input summed to 1.

Even if, say, non-agriculture was rather characterised by increasing returns to scale, this would strengthen my findings. The LDRs experienced a faster growth rate of physical and human capital than the MDRs. Externality effects would therefore be higher in the LDRs than in the MDRs. TFP growth in the LDRs would decrease to a larger extent than TFP growth in the MDRs, reinforcing my baseline findings.

Estimation of reallocation gains: Static vs. dynamic environment, demand effects, and welfare implications Reallocation gains are estimated within a static environment. In the model, there is no dynamic interaction between sector-specific physical and human capital. For example, in a static setting, the transfer of human capital from agriculture to non-agriculture decreases the marginal product gap by increasing the marginal product of human capital in agriculture, while decreasing it in non-agriculture. This process causes an increase in aggregate

efficiency. In a dynamic setting, physical capital would follow human capital in response to a more efficient allocation of human capital, reinforcing the impact on aggregate efficiency. Thus, within a dynamic setting, reallocation gains would likely be higher than within a static setting. It therefore seems likely that this paper underestimates actual reallocation gains and hence overestimates TFP growth.

As a reminder, reallocation gains are determined as a ratio of actual to potential income, where potential income is simulated. Estimated potential income does not reflect potential changes in relative prices arising from demand effects. A shift of factors from agriculture would decrease agricultural production, leading to an increase in agricultural prices, which would increase the marginal product of the remaining factors. Neglecting demand effects thus overestimates reallocation gains. Nevertheless, Vollrath (2009) reports that simulated changes in relative prices have a minor impact on measured reallocation gains. Furthermore, this appears to be an unlikely issue within a socialist system where prices were largely administered.

Finally, the model neglects costs that are associated with migration. For example, next to pecuniary costs, labour migration involves physic costs. Nevertheless, it is important to distinguish efficiency gains from the perspective of aggregate economy, and welfare implications at individual or societal level. While structural modernisation certainly has strong, more broader, welfare implications, this paper exclusively focuses on productivity implications.

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