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TRANSFORMATION: CROATIA, 1970-2008**

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Wage Inequality and the Labor Market Impact of Economic Transformation: Croatia, 1970-2008

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Abstract: In this paper, we examine wage inequality and wage differentials in Croatia from 1970 to 2008 using two long aggregate time series on the distribution of income. We focus especially on changing income inequality related to educational and vocational attainment, changing income inequality within those groups, and how these two components of inequality were affected by the economic transformation from Socialism to capitalism. We find that income inequality between groups rose moderately post-transformation, while overall inequality increased more sharply. This finding is consistent with a growing importance of individual rather than group productivity in labor market compensation, a change broadly consistent with the economic transformation of the Croatian labor market.

JEL Codes: J3, P2, P23, E34

Keywords: Croatia, Economics of Transition, Inequality, Gini coefficient

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1. Introduction

In this paper, we examine wage inequality and wage differentials in Croatia from 1970 to 2008. This period covers, of course, a tumultuous time for Croatia: the economic transition from socialism to a market-based economy, the break-up of Yugoslavia, two bouts of hyperinflation, and the Homeland War. Croatia is a particularly interesting place to examine the impact of economic transition because its form of central planning was far more decentralized and market-related than most other transition economies. We focus especially on changing income inequality related to educational and vocational attainment, changing income inequality within those groups, and how these two components of inequality were affected by the economic transformation.

Relatively little is known about inequality and wage differentials in Croatia over this longer time period. Somewhat more is known about the transition period, where microdata from the Croatian Labor Force Surveys have been analyzed; see, for example, Nestic (2005a) and Vujcic and Susic (2009). But such data do not exist for the pre-transition period. Thus, we use, instead, aggregate data from two official wage series. These data sources enable us to assess changes in wages by skill level as well as changes in the overall distribution of income and also to look before, during, and after the economic transformation. The different focus of the two data series also enables us to identify some of the underlying sources of the changing inequality we find. Our goal in this paper is, therefore, twofold: to provide a fuller picture of inequality in Croatia over this longer time period as well as provide some insight into the effects of the economic transition and other significant events on the nature of inequality in Croatia.

We find that average wage differentials by education and vocational training narrowed through the mid-1970s, stabilized over the next decade, and then increased again in the first decade following

transition. Our broader measures of inequality by income groups show a relatively flat pattern through the mid-1980s, but sharper increases thereafter; for example, the Gini coefficient rises from the .20-25 range between 1970 and the mid-1980s to .30 and over since the late 1990s, and the 90/10 earnings ratio shows a similar pattern. The greater post-transition increase in overall inequality than in inequality related to differences by education and vocational attainment suggests rising income inequality within educational and vocational attainment groups, a change consistent with a labor market that rewards individual skills more strongly. This change is broadly consistent with developments in other economies, including the U.S., and with the transformation from a centrally planned to a market economy.

The plan of this paper is as follows. Before turning to the measurement of inequality, we begin, in the next section, with background on the labor market framework and institutions that characterized Croatia during these years. The third section discusses the relatively small literature to date on Croatian income inequality. In Section IV, we outline the data and methods we use. Our analysis of wage dispersion and wage inequality in Croatia and how it was affected by the economic transformation is presented in Section V.

2. Labor Markets in Croatia

The almost 40 year period under consideration can be divided into two nearly equal sub-periods – the socialist period that lasted through 1989 and the capitalist period that followed. In the socialist period, labor in Croatia had an unusual position by virtue of Yugoslavia's unique socialist ideology. As a nominally socialist economy, labor was not accepted as a genuine market commodity, which meant that labor markets were not institutionally recognized. However, the distinctive socialist ideology in Yugoslavia included workers' self management, which implied substantial firm independence and market exchange, and the absence of central planning.

Whether or not Croatia had genuine functioning labor markets during this time period is open to debate. The population could freely move and choose where to work and firms were formally free to choose their employees. In contrast to centrally planned economies, 'open' unemployment was recognized. Also, there were trade unions and a legislative framework for labor relations, and, via Yugoslavia, Croatia was a member of the ILO. With the exception of periods with particular stabilization policies, firms had complete formal freedom to choose who to employ.

At the same time, however, the actual system did not operate according to market principles in three important respects. First, wage rates did not serve standard allocative functions. Second, the legislative framework still guaranteed almost complete job security and provided incentives for over-employment. Third, firms and their labor relations practices were subject to substantial external ideological forces, through legislation, regulation, and political pressure. On balance, we believe that even though some of the institutions of labor markets existed, labor allocation and wage determination was under the dominant influence of non-market factors and thus a labor market as an institution did not dominate.

The capitalist period begins with the economic transformation to a decentralized capitalist system in 1990, coincident with the breakup of Yugoslavia. With the transformation came the acceptance of labor markets and capital markets, so that wage inequality and wage differentials could be viewed as legitimate labor market outcomes reflecting opportunity costs. The egalitarian ideology and its consequent regulation of incomes and the inherited institutional framework of the socialist period were formally declared unacceptable and abolished.

New institutional arrangements for the labor market developed in the mid-1990s, following the economic transformation. In 1992, the first national collective contract was signed and new Labor Code was established in 1995, but it actually included provisions that maintained substantial labor market

inflexibility.¹ It was not until 2003 that the labor code was revised to include provisions that radically transformed labor markets: the state lost its monopoly on job mediation; the labor market was liberalized and unemployment benefits were reduced; and the first elements of employment and wage contract flexibility were introduced, reducing the costs of layoffs and the right to redundancy pay and unemployment benefits.

The collective bargaining contract for public sector employees (including state owned firms) in Croatia is particularly important for understanding wage inequality during this time period. This is because the public sector still is the dominant form of employment and the collective contract is a kind of benchmark for others. This collective contract defines wage differentials for eight wage classes and 24 wage brackets, all linked to levels of professional attainment.² After 2000 there was an increasingly widespread practice of 'managerial contracts' that regulate the payments of some employees by direct individual negotiations and personal contracts not subject to the collective agreement.

3. Income Inequality in Croatia

The earliest works on inequality in Croatia using state of the art analysis are Bićanić (1984, 1988) and Milanović (1990). Bićanić (1984) is the only work in which inequality was measured for the constituent republics of Yugoslavia (and later independent states) and thus is the first source on Croatian inequality. After Croatia became independent, most early analyses of economic inequality were based on rough estimates and deductive reasoning due to a lack of data about the transformation generally and about inequality; for an early general survey, see Atkinson and Micklewright (1992) and for a Croatian perspective, see Bićanić (1992). This approach developed into the stylized facts of the transformation and was reflected in the most influential publications on the transformation (World

¹ For example, the new code included advanced notice, severance pay, and preference for full-time employment.

² Initially they were expressed as multiples of the basic wage of unskilled labor, but more recently they are in terms of the national average wage from the previous period.

Bank, 1996; EBRD Transition reports; Milanović, 1999). This view held that market liberalization, privatization, and institutional deficits leading to quasi-rents would lead to a major increase in inequality during the initial period of the transformation, after which inequality would stabilize or decrease under the influence of competitive pressures, institution building, and increased policy capacity.

Serious study of economic inequality in Croatia started after a World Bank initiative on economic inequality that eventually led to two World Bank reports (World Bank, 2000a, 2000b). Following that, Nestić, the main Croatian economist involved in the project, published the first post-1990 analytical work on Croatian income inequality from household income and consumption surveys conducted in 1988 and 1998 (Nestić, 2002).³ He reports that the Gini coefficient increased by about 8 percent over this time period (Nestić, 2002, p.607). In a later paper (Nestić, 2005b), the period of analysis is extended from 1998 to 2002, resulting in a slightly larger increase in inequality. He concludes that over this period inequality of income from paid employment increased and that wages made the greatest contribution to total inequality. Other recent contributions include Nestic (2005a) and Vujcic and Sosic (2009), who provide an analysis of wage equations and the returns to education using microdata for 1996 and 2004.

Leitner and Holzner (2008) compare Croatia to other Central and East European economies. They first establish that Croatia has relatively low levels of inequality and then show that the Croatian data fits into the pattern of Central European, Baltic and Eastern Balkan economies whereby higher union density and larger coverage of collective agreements leads to lower Gini values. They do not compute income inequality measures for Croatia nor consider time trends. The only paper that we have identified that uses some of the data that we use is Aksentijevic, Bogovic, and Jezic (2006), who report

³ The two surveys are not quite comparable. The data for 1988 comes from the last of the regular Five Year Household Income and Consumption Surveys conducted in Yugoslavia and its constituent republics, while the data for 1998 is from a World Bank-sponsored household consumption survey. The 1998 survey omitted around 10% of the territory and 5% of the population hardest hit by the Homeland war. Thus the 1998 data probably underestimate true inequality. Nestić argues that this did not significantly influence the results (Nestić, 2002, pp. 98-100).

on income differences by educational and vocational attainment from 1996 through 2002. The authors do not, however, consider aggregate measures of inequality, nor examine a longer time trend that would permit comparisons before and after economic transformation. They also do not use the second wage series that we examine in our paper.

4. Data and Methods

Data. We use two data sources in our analysis of Croatian income inequality. The first provides information on the distribution of fully-employed workers⁴ by net monthly wage intervals and the second provides information on average net monthly wages by level of education and vocational training. We refer to the former as our “income interval” data and the latter as our “attainment” data. Both series are based on regular reports provided by employers to the Yugoslav Republican Statistical Office through 1990 and to the Republic of Croatia Central Bureau of Statistics since then;⁵ the resulting data series include 70% of persons in each industrial category of the National Classification of Economic Activities and thus provide much fuller coverage of workers and their wages than other sources. The data cover all of Croatia except for 1991-1995, when data from the temporarily occupied territories are omitted. Until 2004, all data were published only in paper form, so all pre-2004 data needed to be transferred to electronic form. To our knowledge, the income interval data have not been used in any

⁴ Fully employed workers work at least 182 hours a month. Partially employed workers are omitted. The survey covers firms with at least 15 employees.

⁵ During the Yugoslavia period, data was published separately for the constituent republics, including Croatia. The survey was the RAD-1 questionnaire until 1989 and the RAD-1G questionnaire since 1996. Firms were required to submit wage information to the statistical office. Until 1995, reporting was conducted twice annually, (March and September), except in 1980 and 1981 when only September data was collected due to preparations for the 1981 population census. After 1996, reporting occurred once every year in March. In order to make our analysis consistent over time, we use only the March data throughout. Results were published in the Statistical Yearbook of the Republic of Croatia during the whole period with the exception of 1988 to 1996, when they were published only in specialized statistical announcements.

analyses of income inequality in Croatia and the attainment data have been used only in the 1998-2004 analysis of Aksentijevic, Bogovic, and Jezic (2006).

The income interval data are available annually beginning in 1973, with the exception of 1980 and 1981. The attainment data series is available approximately every other year beginning in 1970 through 1990, and then annually through 2008. For the 1989-1995 period, we have wage data for each education and vocational training group, but the corresponding employment shares needed to compute aggregate inequality measures are unavailable. This gap coincides with the breakup of Yugoslavia in 1990 and the Homeland war from 1991 to 1995.

The first publicly available microdata set for Croatia is the 1996 Croatian Labor Force Survey (CLFS), followed by the 2004 CLFS. Prior to that and therefore throughout the Socialist period, no microdata exist, which is why we use aggregate data instead. It is important, therefore, to establish that the aggregate data are representative and that they do provide a reasonable time-series of labor market outcomes in Croatia.

To do that, we compare tabulations and key results from our data series to those from studies using the CLFS for the same year. That comparison is, in fact, very encouraging. Nestic (2005a) and Vujcic and Susic (2009) use the CLF surveys to estimate human capital earnings functions for Croatia. Their papers present useful information about the distribution of educational attainment and the industrial composition of employment that we attempt to replicate with the aggregate data. When we do that, we find a very close correspondence. For example, in 2004, the average difference (absolute value) in employment percentages by industry for 15 industries is .54% comparing the aggregate data to Vujcic and Susic and 1.08% compared to Nestic. Educational attainment distributions also line up very closely for comparable educational categories. The aggregate data also matches the earnings differences by education level reported by Nestic (Table 1) for 2003 and the increase in earnings

differences by educational attainment found by Vujcic and Sosic (Appendix Table 3). Nestic finds that individuals with a college degree or more⁶ earn 60% more than the average worker and 75% more than those who graduated from secondary school; the corresponding percentages from the aggregate data for that year are 60% and 74%. Vujcic and Sosic report an increase in the return to a year of education from about 5% per year in 1998 to 6.25-7.8% in 2004.⁷ In the aggregate data, we cannot compute a comparable return by single year of education, but we do find that the average earnings difference between college graduates and those with a secondary degree increased over this time period from 61% in 1996 to 76% in 2004, and the difference between those with a non-university degree and a secondary education increased from 21% to 32%. These results suggest to us that the aggregate data are broadly consistent with the CLFS. While we cannot, of course, confirm the validity of the aggregate data in the era before the microdata becomes available, the correspondence in the post-transition era is encouraging in this regard.

The other key question for our analysis is whether the two data sets that we use are similar enough that we can use them for comparative analyses. On the whole, we think the answer is yes, especially in the transition period. As we noted above, both are derived from the same employer survey. The two wage series are substantially overlapping in terms of population coverage. The wage data by attainment are based on wage reports for 1.0-1.5 million workers through 1988 and then 0.9-1.1 million workers thereafter. Sample size for the income interval data is not published in most years, but in the 2000s, when it is available, the sample is about 90-95% of the attainment sample. In addition, average income in the two series is similar in most years.⁸ We have an average wage for both series in 25 years from 1974 to 2008. From 1974 to 1985 (five observations), the average wage in the attainment data is

⁶ This calculation combines two separate groups in Nestic's analysis.

⁷ The higher figure in 2004 is for women.

⁸ The average is provided directly in the attainment series; in the income interval data, we compute it from the average income and population shares in each bracket

about 10-12 percent higher than the corresponding average in the interval data. From 1988 to 1993 (five observations), the two series diverge substantially, with the attainment average wage 30-40 percent higher in 1988 and 1990 and twice as high in 1992 and 1993. These are the tumultuous years of hyperinflation, political separation, and war; the sample is restricted in those years, as well. But thereafter, the two series track extremely closely, never differing by more than two or three percentage points. Where feasible, we focus primarily on the 1970-88 and 1994-2008 periods, where the two series are more closely aligned.

Our data sets have some weaknesses that limit what we can do. As we have already noted, microdata do not exist for the early period. The aggregate data series do not include wages and employment for workers in crafts, trades and “freelances,” the military, or for independent farmers. In the interval data, the income intervals, especially the top interval, were not always adjusted fully for changes in nominal wages. As a consequence, we are not able to estimate inequality caused by high earners as consistently across the time periods as well as we would like. In addition, we do not know the average income in each income interval and thus must make some assumption about the distribution of income within intervals. For the closed intervals, we assume that the interval mean equals the midpoint of the interval, an assumption consistent with many underlying distributions. For the open top interval, we assume that the average income is twice the minimum, although we explore allowing the average income to vary with the population density of the top bracket.

Methods. We use the attainment data to calculate group earnings differentials and a Gini coefficient. We use the income interval data to compute a Gini coefficient and the 90/10 income ratio, a measure that complements the Gini. Given the nature of our data, we use the appropriate grouped data formulas to compute the Gini coefficient. For the interval data, we compute both lower and upper bounds since we have no information about the distribution of incomes within groups. The Gini upper

bound value assumes maximum inequality within every bracket (i.e., all income recipients have either the maximum or minimum income in the bracket), while the Gini lower bound values assume no inequality within a wage bracket (all income recipients have income equal to the mean of the income bracket). For the attainment data, the Gini corresponds to the lower bound measure.

The Gini coefficients calculated from the two data sets represent different aspects of overall inequality, a difference that is revealing. The Gini based on the attainment data reflects only those income differences linked to average incomes and population shares by level of education and vocational training. It tells us what would have happened to inequality over time if all workers with a given level of education or vocational training had the same income, a difference often referred to as *between-group inequality*. The corresponding Gini based on the interval data reflects the actual distribution of individual incomes, including both the between-group differences and any additional income differences that arise among individuals within skill groups. These latter income differences are often referred to as *within-group inequality*. As a result, the difference between these two measures is a measure of the importance of within-group differences, that is, wage payments based on individual characteristics and/or productivity, rather than average group characteristics.

The widening of both between-group and within-group earnings differences are two of the established facts of rising inequality in the US over the past few decades (Katz and Autor, 1999; Goldin and Katz, 2008).⁹ As noted above, evidence in Vujcic and Sosic (2007) indicates that the return to education – a measure of between-group differences—increased in Croatia between 1996 and 2004, and a similar pattern has been noted in other transition economies; see, for example, Rutkowski (1995) for Poland, Campos and Jolliffe (2004) for Hungary, and Clark (2000) for the Czech Republic. By

⁹ In the US, rising between-group income differences by education is attributed either to skill-biased technological change and/or to weakening institutional constraints (Card and DiNardo, 2002). Rising within-group earnings differences, often referred to as residual inequality, are typically attributed to unobserved individual productivity differences.

comparing inequality from the attainment data to that based on the full distribution of individual income, we can get some insight into the importance of within-group earnings differences in the pre- and post-transformation Croatian economy. We speculate that the economic transformation might well have increased the relative importance of individual productivity relative to average group productivity if it provided an economic environment with enhanced profit motives and if decentralized labor markets and wage-setting allowed wages to be more closely aligned with individual marginal products. We think both of these conditions likely held to a greater degree in post-transformation than pre-transformation Croatia. If so, we would expect to see a greater increase, post-transformation, in inequality measured with the income interval data than in inequality measured with the attainment data. Because Croatia was widely considered a transformation laggard, it is possible that these effects could appear with some time lag.

5. Wage Inequality and Wage Differentials in Croatia, 1970-2008

We begin by examining wage differentials across selected educational and vocational attainment groups. Educational and vocational attainment are classified according to the ILO definitions and include eight categories for four education levels (University Degree,¹⁰ Non-University Degree, Secondary, and Basic) and four vocational levels (Highly-Skilled, Skilled, Semi-skilled, and Unskilled) that involve subsequent technical training after the completion of basic education. The groups are mutually exclusive. Rather than show the trend for each group separately, we show in Figure 1 the time trend of the earnings premium for three comparisons of interest: college-educated workers relative to workers with secondary education, workers with high-skill vocational training relative to semi-skilled workers, and the overall range (college to basic education). We would expect to see skill-based wage differences increase with the transformation, at least initially.

¹⁰ This category includes Doctoral, Masters and Bachelors' degrees.

Wage differentials for all three comparisons are conspicuously high at the very beginning of the time period (1970). High-skilled workers earned 85% more than semi-skilled workers and college-educated workers earned 75% more than workers with a secondary education; the overall range is more than 2:1. But all of the wage differentials decline sharply in 1972 and again in 1974. These differentials likely reflect a pro-market reform in 1965 that lasted until 1972, when a regime change swung the pendulum away from markets and into indirect control of markets. From the mid-1970s through the end of the Socialist period in 1988, the wage premiums for the two skilled groups shown are stable, although the range continues to narrow through about 1985 before rising. Wage differentials in the 1988-95 period, with its hyperinflation episodes and Homeland War, are divergent: sharply declining for high skilled workers v semi-skilled (from 53% to 36%); rising and then declining for college-educated compared to those with a secondary education, but with a net increase; and rising and falling for the overall range, but with a net compression. But with the transition, the earnings premiums for more educated and more skilled workers at the higher end of the wage distribution increase very steadily through the early 2000s, as does the overall range. This pattern is quite consistent with the findings about the rising return to education reported by Vujcic and Susic (2009). Starting in approximately 2003 most of the wage differentials are flat.

These patterns suggest a likely decline, followed by an increase, and then possible stability in income inequality among the educational and vocational attainment groups over this nearly 40 year time period. We can measure that more carefully by computing the Gini coefficient (“attainment Gini”) based on the average wages and employment shares for each of the eight groups. As we noted above, this Gini coefficient measures the inequality arising from changing relative wages for the different groups over this time period. With the income interval data, we can compute a more comprehensive measure of inequality that accounts for both changing averaging wages for different attainment groups and any additional changes in income distribution within groups. With this data, we compute a lower-

bound Gini (“interval Gini”) and the ratio of earnings at the 90th and 10th percentiles. The 90/10 ratio is inferred from the grouped income distributions by linear interpolation within each interval; it is approximate, but the trend is sufficiently clear that the approximation is certainly acceptable. We concentrate on the lower-bound Gini because it is more directly comparable to the Gini computed using the attainment data.¹¹

Figure 2 shows all three of these measures. The two Gini coefficients are measured on the left-hand axis and the 90/10 ratio on the right-hand axis. As expected, the attainment Gini is lower than the interval Gini, because it captures only inequality arising between groups. Between-group inequality declined sharply in the early 1970s, paralleling what we saw with earnings premiums by education and skill in Figure 1. With the exception of one small uptick in the mid-1970s, inequality in this dimension continued to decline slowly through 1983; that year, along with 1985, are the low points over the entire time period. Our data points are much thinner over the next decade – we cannot compute the Gini by attainment level between 1988 and 1996– but inequality was about the same in 1996 as 1983, rising just .005. Then inequality between skill groups increased steadily through 2000, coinciding with the trend seen in Figure 1, at which time it stabilized at this higher level. The attainment Gini has barely changed at all since 2000.

A rather different picture emerges from the interval data. Here we see a steady secular increase in overall wage inequality with both measures. Looking first at the 90/10 ratio, the ratio is constant at about 2.5 from 1970 to 1988, nearly the full Socialist period. Then the ratio jumps sharply six years in a row (through the period of war, hyperinflation, and the initial economic transformation) to a value of 3.59. The trend is a bit noisy thereafter, but that probably reflects the interpolation procedures. Since

¹¹ The trend in the upper-bound Gini is quite similar in trend to the lower-bound Gini and differs by no more than two to three percent in most years.

2000, the ratio has been consistently in the 3.3-3.4 range with the exception of a single dip in 2000. The interval Gini also shows this increase in inequality with a strikingly similar time pattern. The Gini coefficient ranges from 0.21 to .26 through the mid-1980s, then increases, with an erratic pattern, to the .30-.35 range post-transformation. There is little doubt here that the overall trend in incomes shown here is toward greater inequality, with a modest increase post-transition in group-based wage differences and a much larger increase in overall inequality.

A comparison of the inequality trends derived from the attainment data and the income interval data is quite revealing about what may have been going on in the Croatian labor market, especially before and after the economic transformation. In the 1970s and early 1980s, the difference between the two measures is about 0.08-0.10 and the two mostly move in tandem. Over this time period, the attainment Gini is about 60% of the value of the interval Gini, which means that the remaining 40% of overall inequality is related to within-group differences. But the difference between the two measures jumps sharply in the mid-1980s and thereafter to about 0.14-0.16. The attainment Gini is now about half the income interval Gini, implying an increase in the portion of inequality linked to pay differences within the groups. Indeed, between 1988, the last common year of observation for both data series in the Socialist era, and 2008, the attainment Gini increased .018, while the interval Gini increased .075. This tells us that changing between-group inequality accounted for only about 25% of the increase in overall inequality over these years ($.018/.075$), with the remaining 75% attributable to growing within-group income differences. This trend almost certainly indicates that the relative importance of pay by nominal characteristics and by average productivity (i.e., group earnings differences) was declining and that pay linked to individual productivity was on the rise, a change roughly consistent with a move to a market-based economy.

Table 1 summarizes these trends across three time periods: the Socialist period; an interim period that covers the turbulent years of independence, war, hyperinflation and early transformation; and the more mature capitalist period. Because we want to compare the trends for the two measures, we focus on the period from 1973 to 2008, using the average of 1972 and 1974 to create a 1973 Gini value for the attainment data. We use 1989-1995 to define the interim period¹² and the years before and after for the Socialist and mature capitalist periods. The table shows beginning, end, and average values for the two Gini measures and the 90/10 ratio, and also the proportion of inequality attributed to within-group income differences.

During the Socialist years, the average Gini from the income interval data is 0.237, the average 90/10 ratio is 2.56, and the average Gini from the attainment data is 0.135. This means that 43% of the inequality ($.102/.237$) is related to the difference in average wages within the education and vocational attainment groups. During the interim period, the interval Gini and 90/10 both increase substantially; not shown in the table is the substantial variation around the mean values. Because we cannot compute the attainment Gini for those years, we cannot determine the proportion of total inequality linked to wage differences between and within groups. In the capitalist period, the average Gini with the income interval data is 0.308, up 0.031 from the interim period average and up more than 0.07 from the Socialist period average; the capitalist period ending value is up 0.079 from the end of the Socialist period. The average 90/10 ratio is up just a very small amount over the interim period, although the period ending value is up much more. Finally, the proportion of inequality within groups is up substantially from the Socialist period. That proportion is now about 50% ($.155/.308$) for the whole capitalist period.

¹² Recall that this is also the time period when the income interval data matched poorly with the attainment data and where we cannot compute a Gini coefficient from the attainment data because employment shares are missing.

To examine these trends more formally, we estimated very simple time trends of inequality in the Socialist and post-war capitalist periods, 1973-88 and 1996-2008, respectively. We estimate the time trend for overall inequality (the interval Gini) and for within-group inequality (the difference between the interval and attainment Ginis). We use a parsimonious specification with just a linear trend and a dummy variable for two outlier years (1985 in the Socialist period and 1998 in the capitalist period) that would otherwise distort the broad trend. Our results are summarized in Table 2.

For the Socialist period, we have 14 observations for overall inequality, but only six years for within-group inequality because the attainment data were collected every other year and the interval data were not collected in 1980 and 1981. The years in common are 1974, 1976, 1978, 1983, 1985, and 1988. The smaller sample appears to be representative of the full sample: the mean and standard deviation of the interval Gini is the same in both samples (.240 and .019, respectively). As shown in row (1), overall inequality rose at an average annual rate of 0.0011; the estimate is not statistically significant ($t=0.8$), due to the small sample.¹³ Within-group inequality rose more rapidly at a rate of .0016 per year; this effect is statistically significant at the five percent level. The trend in the 90/10 ratio is very small in magnitude (.0027) and not statistically significant. After the economic transformation, we find that all the inequality time trends increased. The 90/10 ratio increased at a statistically significant 0.0325 per year, more than 10 times the annual rate of increase in the Socialist period. Overall inequality rose at a 0.0044 annual rate and within-group inequality rose at an average rate of 0.0033 annually. These estimates are consistent with our earlier observation that the trend rate of inequality increased after the transformation and also that three-quarters of the increase in overall inequality during this time period reflected changes in within-group inequality.

¹³ The same model applied to the full 14 years yields a time trend estimate of .0015 ($t=1.7$).

Sensitivity Analysis. Our calculation of income inequality using the income interval data is potentially conservative, because we assume that the average income in the top income bracket is always two times the lower bracket value, even though the fraction of wage earners in that top bracket varied from as little as 0.5 percent to as much as 8-10 percent. We can test this assumption by letting the average income vary with the population density of the top bracket to see how much of a difference it makes in the Gini coefficient. To do this, we let average income in the top interval equal $(1 + (\delta_t/X)^{.5}) \times Y_{\min}$ where δ_t is the percent of the population in the top interval in year t, Y_{\min} is the bracket lower interval, and X is the average percent in the top bracket over the entire time period. With this adjustment, the mean income in the top interval equals twice the interval minimum in years (our baseline assumption) when the sample proportion in that interval equaled its mean value over this time period (3.2%), 2.4 times the minimum when the proportion in the interval was twice the mean, and about 1.7 times the mean income when the proportion was half of the mean proportion. This assumption is admittedly arbitrary, but the results are instructive.

From 1973 to 2003, the two sets of Gini coefficients track very closely except for substantial spikes in 1985 and 1989 when the fraction in the top bracket averaged about nine percent. But beginning in 2003, the two measures diverge steadily. Over this time period, the lower income threshold for the top bracket was constant at 8001 HRK, even though average incomes rose steadily in real terms. The proportion in the top bracket increased by about one percentage point a year, from 4.2 percent in 2004 to 8.5 percent in 2008, so, in conjunction with the constant income threshold, it is certainly plausible that the average income in the bracket also increased. Our adjustment increased the income share of this interval in 2006 from 21.5 percent to 24.8 percent and in 2008 from 26.3 percent to 32.0 percent. As a result, the corresponding Gini coefficient rises steadily and diverges from the one presented in Figure 2. In 2004, the two Gini coefficients differed by just 0.005, but thereafter our original estimate of the Gini coefficients increases by 0.03 to 0.346, while this new estimate Gini

increases almost six percentage points to 0.370. This, in turn, would imply a greater increase in within-group income differences. Thus, it is certainly possible that overall inequality and the proportion due to within-group income differences in the mid-to-late 2000s are both higher than we report.

6. Summary and Conclusions

In this paper, we have used the available Croatian data on income by income intervals and by educational and vocational attainment to measure wage dispersion and wage inequality in Croatia from the early 1970s through 2008. Using the two data series together reveals changing aspects of inequality, namely, the differences in inequality between educational and vocational attainment groups and within them. We also examined differences in inequality across industrial sectors, focusing on industries that experienced quite different economic shocks during the transformation from socialism to capitalism.

Our analysis is necessarily constrained by the unavailability of microdata that would enable us to go beyond the income interval data and avoid the need to make assumptions about the underlying distribution. Access to microdata, at least in the current period, would improve our estimates of average income and also of the inequality contributed by the top income bracket. In addition, the data series we use have time gaps and the samples are not fully inclusive of all wage earners. Still, the two long consistent data series we use are an improvement over the data used in other analyses of Croatian income inequality.

The two data series, used in conjunction with one another, tell a quite consistent story about the development of labor markets in Croatia. The period we examine is a tumultuous one in Croatian history, including, as it does, not only the transformation of the economy, but also the creation of sovereign Croatia, the Homeland War, multiple bouts of hyperinflation, and the initial integration into Europe. We have documented a general increase in overall inequality, with a rising trend in the post-transformation capitalist period. The Gini coefficient based on income interval data rose from an

average value of about 0.23 in the Socialist period to 0.31 in the capitalist period, with a value in 2008 of 0.333. The increase in overall inequality occurred in spite of a flat trend in wage differences among groups classified by educational and vocational attainment; the Gini coefficient based on wage differences by attainment level rose very slightly over the entire time period. Taken together, these two inequality trends point to growing inequality among individuals within educational and vocational groups, a finding confirmed in our simple time-series analysis. In the capitalist period, we estimate that 75% of the increase in inequality reflects that source. We interpret that finding as broadly consistent with the rising returns to skill reported in most Western economies and with a greater emphasis on individual productivity rather than group characteristics.

We are not drawing normative conclusions from our analysis of the changing nature of wage inequality in Croatia. By most measures, aggregate inequality in Croatia remains relatively low. Wage differentials that reflect productivity levels are an important allocative feature of a market economy. Our analysis does not, of course, allow us to couple productivity with wage levels. Continued monitoring of labor market outcomes in Croatia is advisable. Further analysis with microdata would be another valuable research contribution.

REFERENCES

- Aksentijevic, Nada Karaman, Nada Denona Bogovic, and Zoran Jezic (2006). "Education, poverty and income inequality in the Republic of Croatia," *Zb. rad. Ekon. fak. Rij.* Vol. 24, No. 1, pp. 19-37.
- Atkinson, Anthony and John Micklewright (1992). Economic Transformation in Eastern Europe and the Distribution of Income, Cambridge: Cambridge University Press.
- Bićanić, Ivo (1984). Analiza raspona i nejednakosti primanja stanovništva u Jugoslaviji u razdoblju od 1963 do 1983 godine (Analysis of the range and inequality of personal incomes in Yugoslavia from 1963 to 1983), unpublished doctoral thesis, University of Zagreb, Zagreb.
- Bićanić, Ivo (1988). "Mjerenje nejednakosti u jugoslavenskom selu u razdoblju od 1963 do 1983" ("Measuring the inequality of incomes in the Yugoslav agricultural households from 1963 to 1983"), *Sociologija sela*, Vol: 26, No: 99/100, pp: 101-111.
- Bićanić, Ivo (1992). "The Inequality Impact of the Transition," Proceedings of the 2nd Conference of the European Association for Comparative Economic Studies (EACES), May 1992, Groningen.
- Campos, N. and D. Jolliffe (2004). "After, before and during: returns to education in Hungary 1986–1998," CEPR Discussion Paper no, 4215.
- Clark, A. (2000). "The returns and implications of human capital investment in a transition economy: An empirical analysis for Russia, 1994–1998," CERT discussion paper no 2000/02.
- Goldin, Claudia D. and Lawrence F. Katz (2008). The Race Between Education and Technology, Cambridge: Harvard University Press.
- International Monetary Fund (2007). Republic of Croatia: Selected Issues, IMF Country Report No.07/82, Washington D.C.
- Katz, Lawrence F. and David A. Autor (1999). "Changes in the Wage Structure and Earnings Inequality," in Orley Ashenfelter and David Card (eds.), Handbook of Labor Economics Vol 3A, Elsevier: New York.
- Leitner, S. and M. Holzner (2008). Inequality in Croatia, Vienne Institute for International Economic Studies (WIIW), Vienna.
- Milanović, Branko (1990). Ekonomске nejednakosti u Jugoslaviji (Economic inequality in Yugoslavia), Institute ekonomskih nauka, Belgrade.
- _____ (1999). "Explaining the increase in inequality during the transition," *Economics of Transition*, Vol: 7, pp: 299-341
- Nestić, D. (2002). "Ekonomске nejednakosti u Hrvatakoj 1973-1998" (Economic inequality in Croatia 1973-1998) *Financijska Teorija i Praksa*, Vol. 26, No.13, pp.595-613.
- _____ (2005a). "The Determinants of Wages in Croatia: Evidence from Earnings Regressions", in 65th Anniversary Conference of the Institute of Economics, Zagreb, Proceedings, ed. Lovrinčević et al., pp. 131-162, Zagreb: The Institute of Economics.

_____ (2005b). Income distribution in Croatia: What do the household budget survey data tell us? *Financijska teorija i praksa*, Vol: 29, No: 1, pp: 59-76, and Institute of Public finance, Occasional paper No: 26.

Rutkowski, J. (1996) "High skills pay-off: the changing wage structure during economic transition in Poland," *Economics of Transition* 4(1):89–112

UNDP (2006). Unplugged: Faces of Social Exclusion in Croatia, UNPD-Zagreb, Zagreb.

Vujcic, B. and V. Susic. (2009). "Return to Education and the Changing Role of Credentials in the Croatian Labor Market," *Transition Studies Review*, 16(1): 289-205.

World Bank (1996). From Plan to Market: World Development Report 1996, World Bank Group, Washington D.C.

_____ (2000a). Making Transition Work for Everyone: Poverty and Inequality in Europe and Central Asia, The World Bank, Washington, D.C.

_____ (2000b). Croatia: Economic Vulnerability and Welfare Study, Vol. II, technical papers, The World Bank, Washington, D.C

_____ (2001). Croatia: Economic Vulnerability and Social Welfare, Report No. 22079-HR, World Bank Group, Washington, D.C.

_____ (2007). Croatia: Living Standards Assessment: Promoting Social Inclusion and Regional Equity, World Bank, Washington, D.C.

Table 1: Wage Inequality in Socialist, Interim, and Capitalist Periods, Croatia, 1973-2008

	Gini Coefficient, Income Interval Data	90/10 Ratio, Income Interval Data	Gini Coefficient, Attainment Data ¹	Within-Group Inequality (% of Total)
SOCIALIST PERIOD (1973-1988)				
Initial	0.210	2.55	0.151	28.2%
End of period	0.254	2.70	0.136	46.5%
Period Average	0.237	2.56	0.135	42.9%
INDEPENDENCE, WAR, HYPERINFLATION (1989-1995)				
Initial	0.296	2.93	NA	NA
End of period	0.242	2.92	NA	NA
Period Average	0.277	3.20	NA	NA
CAPITALIST PERIOD (1996-2008)				
Initial	0.262	2.89	0.132	49.7%
End of period	0.333	3.38	0.154	53.8%
Period Average	0.308	3.26	0.153	50.3%

¹ Initial value for Socialist Period is average of 1972 and 1974 values

Table 2. Time Trend of Inequality in Croatia by Type and Time Period, 1973-2008

	Time Trend	Sample Size	R-squared (adj.)
Socialist Period (1973-1988)¹			
Total Inequality (Common Years Only)	0.0011	6	0.467
Within-Group Inequality (Common Years Only)	0.0016**	6	0.902
90-10 ratio	0.0027	14	0.066
Post-War Capitalist Period (1996-2008)²			
Total Inequality	0.0044**	13	0.892
Within-Group Inequality	0.0033**	13	0.936
90-10 ratio	0.0325**	13	0.413

** = statistically significant at the 5% level

¹ Model also includes a dummy variable indicator for 1985.

² Model also includes a dummy variable indicator for 1998.

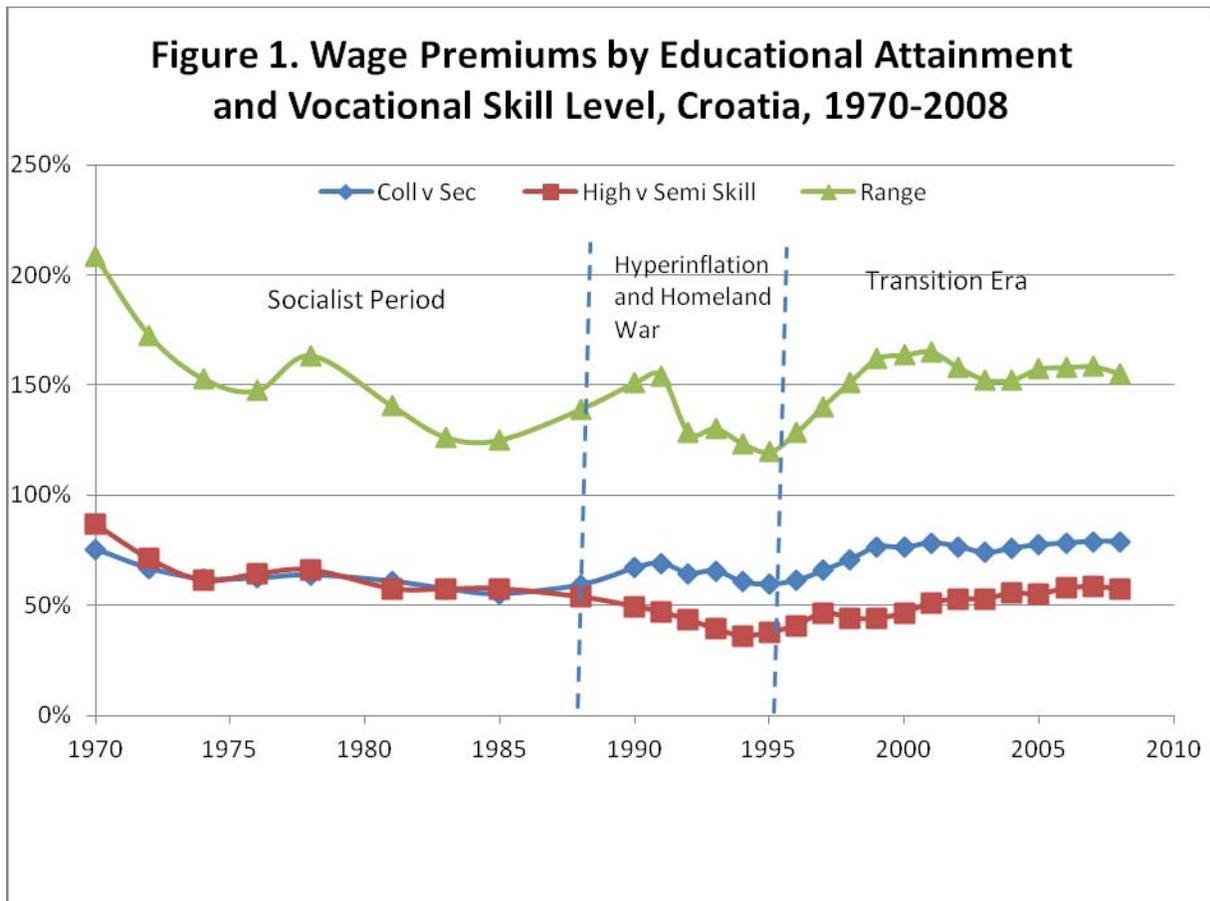


Figure 2. Wage Inequality, Croatia, 1970-2008

