Inequality, living standards, and growth: two centuries of economic development in Mexico[†]

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Historical wage and income data provide both normative measures of living standards, and indicators of patterns of economic development. This study shows that, given limited historical data, median incomes are most appropriate for measuring welfare and inequality, while urban unskilled wages can be used to test dualist models of development. We present new estimates of these series for Mexico from 1800 to 2015 and find that both have historically failed to keep up with aggregate growth: GDP per worker is now over eight times higher than in the nineteenth century, while unskilled urban real wages are only 2.2 times higher, and national median incomes only 2.0 times higher. From the perspective of inequality and social welfare, our findings confirm that there is no automatic positive relationship between economic growth and rising living standards for the majority. From the perspective of development, we argue that these findings are explained by a dual economy model incorporating Lewis's assumption of a reserve army of labour, and we explain why the decline in inequality predicted by Kuznets has not occurred.

I t is a truth universally acknowledged that the consequences for human welfare of different rates of economic growth are staggering.[1] Less widely acknowledged, but equally true, is that human welfare depends primarily on income growth for people, not for countries. This distinction matters because changing levels of inequality can lead to substantial divergence between per capita GDP and the living standards of the majority. For this reason, estimates of real wages for typical workers are indispensable for the study of historical economic welfare. At the same time, since wages are not just a source of income for households but are also a payment to a factor of production, their evolution can tell us about economic structure as well, which allows us to test competing models of economic development.

The goal of this article is to estimate economic welfare and inequality in Mexico from the nineteenth century to the present using new long-run data series on

[1] Lucas, 'Mechanics', p. 5: 'The consequences for human welfare involved in questions like these [the causes of different GDP growth rates] are simply staggering: Once one starts to think about them, it is hard to think about anything else'.

real wages and incomes, and to use them to explore the process of development. We estimate a series for the wages of unskilled urban construction workers in Mexico City from 1800 to 2015, which we consider to be highly consistent and comparable over time. The drawback of this series, however, is that unskilled urban workers might move up or down the income distribution over time, leading to incorrect inferences about the evolution of economic welfare.[2] Therefore we also construct estimates of national median income, which are more representative of the population, but on the other hand are more sparse and less consistent. To track the evolution of economic welfare, we deflate wages using an estimated price index for a subsistence basket. In order to understand the role of inequality in determining welfare, we follow Williamson in using the ratio of per worker GDP y to wages w as a measure of inequality.[3] Where Williamson uses w/y, we use its inverse, y/w, in order to define a measure that is increasing in the degree of inequality. We show that when we set w equal to median income, this measure is consistent with the standard Dalton–Atkinson normative framework of inequality measurement, because the higher this ratio, the less GDP growth contributes to social welfare.

The standard reference for the study of long-run trends in inequality remains Kuznets.[4] While median income is more normatively salient, our series on the evolution of the unskilled urban wage allows us to test the extent to which the economy follows the 'Kuznets process'. Kuznets assumed that the fruits of economic development are shared with workers in the modern capitalist sector. Using a simple dual economy model, we show that this implicitly assumes barriers to mobility between equivalent workers in the modern sector and the traditional sector. We find that Kuznets's assumption is not supported in Mexico, but instead that the assumption made by Lewis, of mobility between sectors, is more plausible.[5]

Our interest in median and unskilled urban wages places our focus in between that of studies of the very rich (as in the recent literature on top incomes) and studies of the very poor.[6] These approaches are complementary: as Piketty notes, 'The social reality and economic and political significance of inequality are very different at different levels of the distribution, and it is important to analyse these separately'.[7] Like Tawney writing over a century ago on British workers, 'what we want to study is not what has brought about the downfall of a small number of people; what we want to investigate are the causes which leave a vast proportion of the population in a condition in which they are liable at every change, under every shock of accident, to fall into this condition of misery'.[8]

Our findings therefore speak to the underlying question of whether economic growth automatically leads to rising living standards for all, or whether it is

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[2] Prados de la Escosura, 'Inequality, poverty and the Kuznets curve'.

[3] Williamson, 'Globalization and inequality'. While Williamson deflates GDP by the GDP deflator and wages by CPI, we compare nominal GDP and nominal wages in order not to mix deflators. This is consistent with the standard approach to measuring inequality, where incomes at different points of the distribution are compared in nominal terms.

[4] Kuznets, 'Economic growth', discussed, for instance, in Piketty, *Capital in the twenty-first century*, and Milanovic, *Global inequality*.

[5] Lewis, 'Economic development'. Thus we follow Ahluwalia, 'Inequality', p. 307, who advises that in testing the Kuznets curve, 'such processes should be examined in an explicitly historical context for particular countries'.

[6] See the World Wealth and Income Database (http://wid.world/, accessed on 20 Dec. 2019) for available top income data and a full list of literature and sources.

[7] Piketty, *Capital in the twenty-first century*, p. 266.

[8] Tawney, *Poverty*, p. 7.

consistent with stagnating living standards for a majority and an increasing concentration of income. The optimistic view is expressed by Clark, who argues that, in today's rich countries, productivity trends have implied that 'The biggest beneficiary of the Industrial Revolution has so far been the unskilled'.[9] Offering a contrasting view, Piketty argues that the dynamics of capitalism only increase inequality over time, and that it took a combination of crises and political interventions to cause the widespread decline in inequality in the mid-twentieth century.[10] Our data indicate that in Mexico real wages little more than doubled from the nineteenth century to the twenty-first century, while real per worker GDP rose eight-and-a-half times. Thus Mexico supports the pessimists' view of long-run trends in inequality.

The rest of the article is organized as follows. Section I discusses the literature on long-run inequality, with a focus on Latin America. Section II describes our data on real wages and median income. Section III explains how our measure speaks to the normative interpretation of inequality. Section IV presents our main results. Section V considers the implications of the short-run movements in living standards and inequality for existing historical narratives of Mexican development. Section VI provides a simple dual economy model which can explain the observed long-run trends in inequality and living standards, and which we use to explain why Kuznets's assumption is not upheld in the case of Mexico. Section VII offers some conclusions.

I.   Histories of inequality and living standards

The historical approach to the study of inequality follows the tradition of Kuznets, Atkinson and Harrison, and Piketty.[11] Kuznets famously postulated that inequality would follow an inverse-U shape over time, driven by economic, political, and demographic factors. He argued that the rise in inequality would be due both to the tendency of the rich to save a higher share of their incomes, and to the early stages of industrialization when the modern sector comprised a small but growing share of the economy. The subsequent decline in inequality, he suggested, would be due both to the spread of the modern sector throughout the economy, and to political reactions against rising inequality of wealth. More recently, Milanovic generalized the Kuznets curve into what he calls 'Kuznets waves' to explain continuing changes in inequality.[12]

Following in the footsteps of Kuznets, and Atkinson and Harrison, Piketty's explanation of inequality trends depends on both economic and non-economic mechanisms.[13] He shows that while the accumulation of capital follows an economic logic, the Great Depression and the World Wars dealt a great blow to

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[9] Clark, *Farewell to alms*, pp. 2–3.

[10] Piketty, *Capital in the twenty-first century*. Scheidel, *Great leveler*, similarly argues that inequality has historically declined only as a result of major crises.

[11] Kuznets, 'Economic growth'; Atkinson and Harrison, *Distribution of personal wealth*; Piketty, *Capital in the twenty-first century*. Also see Piketty, 'Income inequality in France'; idem, 'long-run evolution'; Piketty and Saez, 'Income inequality'; Banerjee and Piketty, 'Top Indian incomes'; Piketty, Postel-Vinay, and Rosenthal, 'Wealth concentration'; Atkinson and Piketty, eds., *Top incomes over the twentieth century*; eisdem, eds., *Top incomes: a global perspective*.

[12] Milanovic, *Global inequality*.

[13] Piketty, *Capital in the twenty-first century*.

accumulated wealth, while political and institutional choices restrained the recovery of private wealth and sustained low income inequality for several decades after 1945. A drawing back of inequality-reducing policies and social norms starting in the late 1970s, combined with the laws of capitalist accumulation, explain the rapid rise in both wealth and income inequality in recent decades in English-speaking countries.

These authors focused on today's rich countries. Turning to Latin America, Engerman and Sokoloff argue that the region's high level of inequality is rooted in extractive economic institutions and power structures dating from the early colonial period. Following this approach, Acemoglu and Robinson further develop the view that economic growth depends in large part on the inclusiveness of political institutions. Reygadas highlights the specific cultural and social mechanisms that in Latin America reproduce inequality over time. These studies purport to explain the persistence of inequality in the region but provide little empirical evidence of changes over time.[14]

Other scholars question the assumption that Latin America has always been one of the world's most unequal regions. Williamson estimates Gini coefficients in Latin America over five centuries based on social tables and GDP-to-wage ratios, finding that inequality was not high by contemporary global standards up to the nineteenth century and probably declined from *c.* 1790 to the mid-nineteenth century, as most of Latin America achieved independence.[15] Inequality surged in the first globalization around 1880–1914, driven by the rise in the terms of trade that benefited a small elite of landowners and capital owners.[16] What is exceptional in Latin America, according to Williamson's interpretation, is that inequality did not retreat in the twentieth century, as it did in developed countries. This view of the twentieth century, however, has been challenged by some country-specific studies. Rodríguez finds that inequality fell over the 1940–70 period in Chile, driven by political forces, while Bértola finds a similar pattern in Uruguay.[17]

For the case of Mexico, three papers present long-run series of inequality through the twentieth century, as part of multi-country studies. Frankema estimates the functional distribution from 1900 to 2000, finding that the labour share cycled up and down with peaks in the mid-1930s and mid-1970s, trending downwards after the 1970s, and reaching a historic low by the end of the twentieth century.[18] Other works place the inequality peak in the mid-twentieth century. Prados de la Escosura estimates Gini coefficients for Mexico from 1913 to 1990, using published Ginis from 1950 and projecting backwards using Williamson's ratio of per worker GDP to wages.[19] He finds that inequality peaked in 1960. Similarly, Arroyo Abad and Astorga Junquera estimate the between-group Gini coefficient for three types

[14] Engerman and Sokoloff, 'Factor endowments'; Acemoglu and Robinson, *Why nations fail*; Reygadas, 'Construction'.

[15] Williamson, 'Five centuries'. Consistent with this, Dobado González and García Montero, 'Colonial origins', find that real wages in mining were medium to high in Mexico over the years 1800–20, and that inequality was relatively low by international standards.

[16] This interpretation is originally from Coatsworth, 'Inequality'.

[17] Rodríguez Weber, 'Political economy'; Bértola Flore, 'A 50 años de la curva de Kuznets'. For a roadmap to the recent literature on historical inequality in Latin American countries other than Mexico, see Bértola and Williamson, eds., *Latin American inequality*.

[18] Frankema, 'Reconstructing'.

[19] Prados de la Escosura, 'Inequality and poverty in Latin America'.

of workers and the 'employers, managers and professionals' group from 1820 to 2000.[20] After relative stability in the nineteenth century, they find a substantial rise up to 1950, followed by a decline until 1980 and another rise in the 1980s. We highlight key differences between these studies and our findings in section V.

The study of living standards over time has benefited from recent innovations in the economic history of real wages, led by Allen's studies of real wages in Europe and subsequently applied to other comparative studies.[21] Allen established a simple methodology that allows long-term comparisons by estimating annual income from the daily wages of unskilled construction workers, calculating the cost of living as a Laspeyres price index for a basic subsistence basket.[22] This approach has been used for several Latin American countries.[23] Challú and Gómez-Galvarriato focus on Mexico from 1730 to 1930, finding cycles of real wage gains and losses up to 1930 with no apparent long-run trend.[24] Other studies have used consumer price indices. Bortz and Aguila provide a comprehensive summary of 30 studies of real wages in twentieth-century Mexico, finding expansions in the post-revolution and postwar periods, and contractions in the early 1940s and from the 1980s.[25] Overall, they find that the average Mexican worker did not make gains in living standards over the twentieth century.

II. Data

One of the contributions of this article is to construct a new and consistent dataset covering living standards from 1800 to 2015. Our primary data comprise four series: unskilled urban construction wages, median income, prices, and per worker GDP. Construction workers' wages are for Mexico City and its environs, prices are based on a basket of consumer goods for Mexico City, and GDP estimates are national. Median income is more sparsely estimated than urban construction wages as they must be derived from nationally representative sources, which are available only in certain years. As measures of inequality we use per worker GDP over urban construction wages, denoted y/w, and per worker GDP over median income, denoted y/w_m.[26] Appendix I discusses the implications of alternative GDP data and wage data sources. Detailed sources and methodology are described in online appendix S1.

The construction wage series is composed of three distinct datasets, each covering different periods but all using data for unskilled construction workers in Mexico City and its environs. This maximizes comparability over time. From 1800

[20] Arroyo Abad and Astorga Junquera, 'Latin American earnings inequality'.
[21] Allen, 'Great divergence'.
[22] The method has been criticized for its use of simplified consumer baskets as well as assumptions about the size of households and number of days worked in a year; see Dobado Gonzáles, 'Pre-independence Spanish Americans'; Humphries and Weisdorf, 'Unreal wages?'. Still, the assumptions hold up well against the evidence in the cases of Mexico and Latin America; see Allen, Murphy, and Schneider, 'Una de cal y otra de arena'.
[23] Arroyo Abad, Davies, and van Zanden, 'Between conquest and independence'.
[24] Challú and Gómez-Galvarriato, 'Mexico's real wages'.
[25] Bortz and Aguila, 'Earning a living'.
[26] Due to a lack of reliable data on the economically active population, we use the number of people aged 15–64 as a proxy. This means that y is underestimated, so the *level* of inequality y/w will also be underestimated. Regarding changes over time, estimates of the working population in INEGI, *Estadísticas históricas*, for the years 1921 to 1960 vary from 0.53 to 0.62 of the working-age population (with no trend), implying variation of up to 17%. This could be interpreted as a margin of error for estimated changes over time.

to 1930, the data are based on Challú and Gómez-Galvarriato's annual series of daily wage rates, built from the payrolls of construction sites in public institutions.[27] From 1940 to 1980 the data are from the Survey of Industrial Work and Salaries (Estadística de Trababajo y Salarios Industriales; ETSI) for Mexico City. These are extended to 1985 using growth rates for all industrial wages in Mexico City, taken from industrial surveys. Finally, we calculate new wage estimates for 1987 to 2015 from the household employment and occupation surveys ENEU (Encuesta Nacional de Empleo Urbano) (for 1987–2004) and ENOE (Encuesta Nacional de Ocupación y Empleo) (for 2005–15).[28]

Turning to median income, we estimate median primary private income of individual recipients. In most cases these are wages, but they can include estimates based on consumption of one's own production. Social tables are the basis for the calculation of five observations from 1800 to 1929, while we use a variety of national censuses and surveys for 1950, 1969, 1977, 1984, and 2005–15. The use of censuses and surveys is straightforward in that they report frequencies by income bracket for the entire country. On the other hand, social tables report income levels for different occupational groups without population frequencies, and therefore we make interpolations and assumptions based on known ratios for other years (see online appendix S1 for details). We aim at reconstructing the income around the median; for this reason, our tables are not suitable for calculating Gini coefficients or other indices based on the entire distribution of income. While our approach does not provide a homogeneous set of classes,[29] it has the advantage of using classifications that were deemed representative by their contemporaries.

These data allow us to assess the place of construction wages in the overall distribution of national income. Unlike Prados de la Escosura's finding for Spain, we find that in Mexico the unskilled construction wage did not fall behind median income.[30] Indeed, for all the years in which we have data over the period 1800–2015, the unskilled urban wage was between 12 per cent and 53 per cent higher than median income with no apparent trend, except for two outliers: in 1950 it was 17 per cent lower, and in 1929 it was 79 per cent higher. These outliers could be due to temporary changes in the economy, or to measurement error. The failure of median income to surpass the unskilled urban construction wage is itself a notable feature of Mexican development, to which we return in section VI.

We estimate living standards by dividing the wage or income by the cost of a basic household consumption basket for 3.15 equivalent adults, the contents of which we keep constant over the whole period.[31] We estimate a new consumption basket post-1930 to link to Challú and Gómez-Galvarriato's pre-1930 'respectable'

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[27] Challú and Gómez-Galvarriato, 'Mexico's real wages'.

[28] We use ENEU and ENOE rather than the commonly used ENIGH survey because their sample of construction workers in Mexico City and Mexico State is much larger than that of ENIGH, averaging 810 per year compared with 86 per year in ENIGH. Wages of construction workers are on average 25% lower in ENIGH than in ENEU and ENOE, implying even less growth in living standards than in our preferred data. See app. I for estimates using ENIGH.

[29] See Arroyo Abad and Astorga Junquera, 'Latin American earnings inequality'; Astorga Junquera, 'Functional inequality'.

[30] Prados de la Escosura, 'Inequality, poverty and the Kuznets curve', pp. 292–3.

[31] The denominator of the welfare ratio, 3.15, is based on an assumption of three equivalent adults per wage earner, adding an additional 5% of total expenses as the assumed cost of housing. See Challú and Gómez-Galvarriato, 'Mexico's real wages', pp. 92–3, for discussion.

basket. In order to make our baskets comparable with present-day estimates, we set the calorie content over the whole period equal to that in Mexico's present-day poverty basket, which represents a contemporary judgement on what counts as a subsistence level of consumption.[32]

We do not presume that this measure of living standards fully reflects well-being. First, it does not capture all household income. Modern surveys confirm that for households containing a construction worker, this worker's wage is typically the primary source of income, comprising on average 58 per cent of total household income. We do not attempt to measure the remaining 42 per cent. Moreover, our measure also excludes benefits in kind that are provided by the government. In 2010, the fifth and sixth deciles of the income distribution received public services estimated to be worth respectively 17.5 and 21.1 per cent of market income.[33] Assuming that these were lower in the mid-twentieth century and close to zero in the nineteenth century, this would imply some additional rise in living standards not accounted for by real wages. Finally, it should be noted that health outcomes and quality of life have improved dramatically over the last two centuries, as demonstrated by substantial increases in life expectancy and heights since the 1930s.[34] However, private incomes are probably less important for health outcomes than public health measures such as improved sanitation and drinking water, and improved health behaviours.[35]

III. The interpretation of inequality measures

Inequality is a normative topic, yet it is not always clear how the historical measurement of inequality engages with normative frameworks. We now show how the inverse Williamson ratio y/w, applied to median income, can be interpreted using the standard Dalton–Atkinson approach. Dalton argued that inequality matters because of what it tells us about the amount and distribution of 'economic welfare'.[36] Atkinson showed that standard measures of inequality can be viewed as measures of distributional inefficiency in the production of social welfare: for any standard social welfare function, it would take less aggregate income to produce the same level of social welfare if that income were distributed equally, rather than unequally.[37]

Since historically we do not have information on the full distribution, we cannot use a standard social welfare function as our normative objective function. Instead, following the Stiglitz Commission, we use the median income as our normative objective function, as a representation of 'what is happening to the "typical"

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[32] The revised average for the 1800–1930 period is a welfare ratio of 0.93, compared to 1.00 in Challú and Gómez-Galvarriato's original series.

[33] Scott, 'Redistributive impact'.

[34] López-Alonso and Vélez-Grajales, 'Heights'. Campos-Vazquez, Flores, and Márquez, 'Long-run human development', also find that literacy rates, school enrolment rates, and the number of physicians per head of population rose throughout the period 1895–2010.

[35] See Deaton, *Great escape*, for discussion of the causes of improved health over time.

[36] Dalton, 'Measurement'.

[37] Atkinson, 'On the measurement of inequality', defined the *equally distributed equivalent income y_{ede}* as the average income required to achieve the existing level of social welfare, if income were distributed equally. Concavity of the social welfare function implies that $y_{ede} < \mu$, where μ is the actual mean income. Thus $I = 1 - y_{ede}/\mu$ is a measure of inefficiency in the production of social welfare.

individual or household'.[38] Thus we interpret the inverse Williamson ratio using Atkinson's normative insight: the higher the ratio, the less efficiently aggregate productivity translates into our objective function of median income.[39]

How does our measure compare with the functional distribution of income?[40] While the functional distribution is informative about the structure of the economy, it has limited normative salience. A key reason is that it depends on *average* labour income, meaning it neglects inequality *within* labour.[41] Consider the following two cases. In the US, from 1966 to 2001 the bottom 90 per cent of the income distribution saw income growth lower than the rate of economy-wide productivity growth, with some parts seeing no growth at all.[42] Only the top 10 per cent gained more, suggesting a rise in inequality. Yet this was also a period in which the labour share increased,[43] implying a decline in 'inequality' in the functional distribution of income. The explanation is that much of the real income gain enjoyed by the top tenth percentile was due to labour income: inequality rose within labour, not between labour and capital. Similarly, in the UK the overall wage share was virtually unchanged between 1954 and 2006, but the income share of the bottom 50 per cent of wage earners fell by one-fifth.[44] In both cases, average wages rose with productivity but median wages did not.

Thus, the median is a more plausible normative objective function than the average wage, and the inverse Williamson ratio using median income can be interpreted within the Dalton–Atkinson framework: the higher the ratio, the lower the rate at which productivity benefits the typical worker.

IV. Inequality and living standards in the long run in Mexico

Figures 1 and 2 provide our findings from 1800 to 2015: figure 1 shows real wages defined as the ratio of the wage to a household consumption basket for 3.15 equivalent adults, while figure 2 shows inequality defined as the inverse Williamson ratio, that is, the ratio of per worker GDP to wages, y/w. Figure 3 then plots real per worker GDP for comparison. We plot the series for both unskilled urban wages and median income, where unskilled urban wages are measured more consistently but, as we discussed above, median income is of more normative relevance. Figure 1 includes the welfare ratio of the minimum wage in the Federal District, which came into force in 1934.

[38] Stiglitz, Sen, and Fitoussi, *Report*, pp. 13–14. Similar emphasis on the normative significance of the median is found in Aaberge and Atkinson, 'Median as watershed'; Cowell and Flachaire, 'Inequality measures'.

[39] In order to produce a more precise analogue to Atkinson's measure one could calculate $A = 1 - (w/y)$ to construct an inequality index that, like the Atkinson index, measures the proportion of y that is 'wasted' because of the unequal distribution. However, we find the inverse Williamson index, of which this is just a transform, more transparent.

[40] Angeles, 'GDP per capita'.

[41] Stiglitz et al., *Report,* p. 14. Another reason is that it ignores the joint distribution of wages and capital income— what Milanovic, *Capitalism, alone*, refers to as the degree of *homoploutia*, or the extent to which it is the same households that receive high labour incomes and high capital incomes. For a formal analysis, see Ranaldi, 'Income composition inequality'.

[42] Dew-Becker and Gordon, 'Productivity growth', p. 125.

[43] University of Groningen and University of California, Davis, 'Share of labour compensation in GDP at current national prices for United States [LABSHPUSA156NRUG]', retrieved from FRED (Federal Reserve Bank of St Louis), https://fred.stlouisfed.org/series/LABSHPUSA156NRUG (accessed on 16 Sept. 2019).

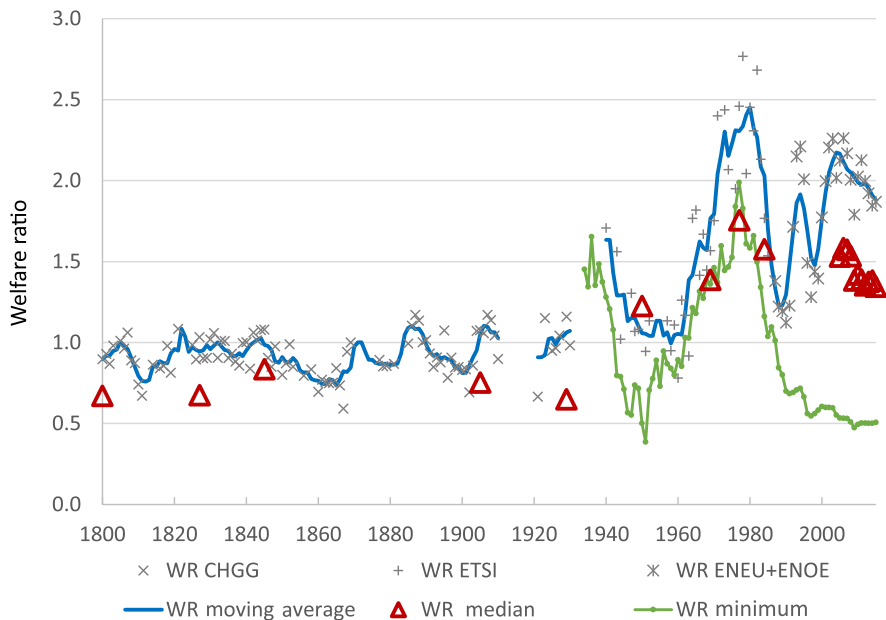[44] Atkinson, 'Factor shares'.

Figure 1.   *Living standards in Mexico, in welfare ratios, 1800–2015*
[Colour figure can be viewed at wileyonlinelibrary.com]

Notes: WR is the Allen welfare ratio for urban unskilled wages, that is, the wage divided by the price of a consumption basket for 3.15 people. WR median is the welfare ratio of the national median wage. Lines are five-year moving averages of the construction wage series; breaks show interruptions in wage series. CHGG is Challú and Gómez-Galvarriato, 'Mexico's real wages'.
Sources: See online app. S1.

Considering unskilled urban construction workers, real wages were trendless but volatile (owing to stable nominal wages but volatile prices) from 1800 to 1930. They experienced a temporary spike around 1940, and then enjoyed a sustained rise from the late 1950s to the late 1970s. They collapsed in the 1980s and then from 1990 to 2015 they oscillated around a level higher than the nineteenth century but below their 1970s average. Inequality, in turn, was low in the nineteenth century (owing to low per worker GDP)[45] and first rose substantially around 1900 as per worker GDP rose but wages stagnated. Over 1900 to 1980 inequality was substantially higher than in the nineteenth century, except for a brief dip due to a decline in GDP in the 1920s and the wage spike around 1940. Inequality then rose dramatically from the 1980s as real wages collapsed. Inequality was its historical highest around 2000, while in 2015 it remained higher than any year prior to 1990.

The most striking finding is that while per worker GDP rose by a factor of 8.5 from the nineteenth to the twenty-first century, the real wages of unskilled urban construction wages rose by a factor of just 2.2, from 0.91 to 2.02. The more normatively salient median income fared even worse: it rose by a factor of 2.0, from 0.73 to 1.44. This implies that inequality as measured by the inverse Williamson ratio rose by a factor of approximately four over the period. In Mexico, the typical worker benefited remarkably little from two centuries of economic development.

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[45] As pointed out by Milanovic, 'Estimate', a lower bound on typical wages due to subsistence needs implies that the maximum feasible inequality is constrained by per capita incomes.
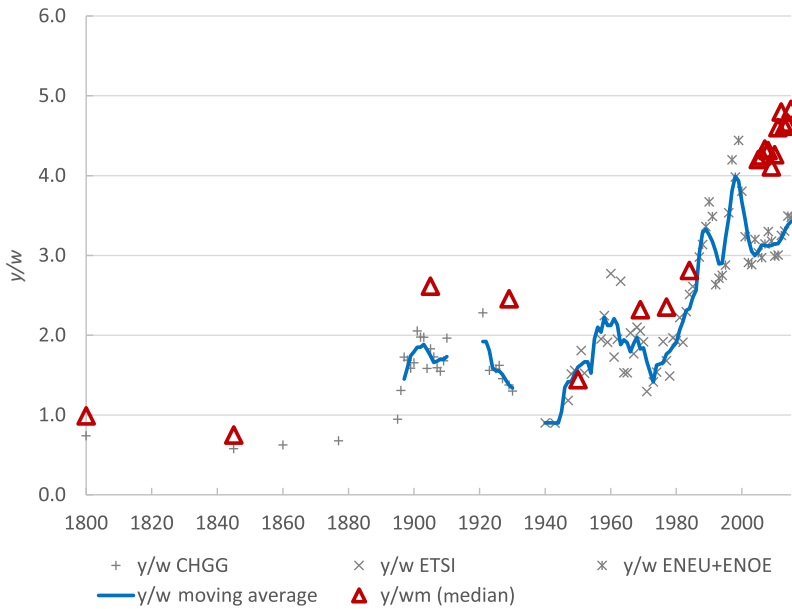
Figure 2. *Inequality in the long run, in y/w ratios (GDP per worker over wages), 1800–2015*
[Colour figure can be viewed at wileyonlinelibrary.com]

Notes: y is nominal GDP per worker; *w* are the nominal construction wage series; *wm* is nominal national median wages. The line is a five-year moving average of the *y/w* estimates. CHGG is Challú and Gómez-Galvarriato, 'Mexico's real wages'.
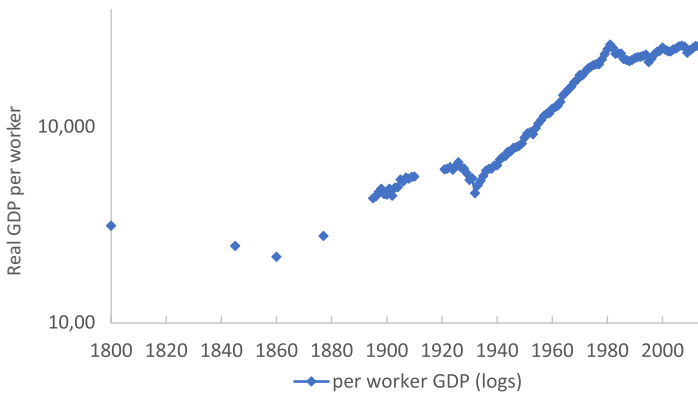*Sources:* See online app. S1.

Figure 3. *Real GDP per worker in constant 1970 pesos, 1800–2015*
[Colour figure can be viewed at wileyonlinelibrary.com]

Note: Data are more controversial before 1900; see online app. S1.
Source: INEGI, *Estadísticas históricas*, tab. 8.1 up to 1970, extended using growth rates from World Bank, 'World Development Indicators'.

The low welfare ratio that we find in the twenty-first century is consistent with official estimates of poverty. Since 1992 the Mexican government has been measuring poverty using absolute poverty lines, with an 'extreme poverty' basket consisting of food only and a 'poverty basket' that also includes other goods and

services.[46] Our estimated consumption basket is scaled to contain the same number of calories as these modern baskets. Over the years 1992–2015 the cost of the urban extreme poverty basket averages 1.33 times that of our basket, owing to the greater variety of foodstuffs, while the cost of the urban poverty basket is 2.95 times higher. This means that welfare ratios based on versions of these baskets would be correspondingly lower—though the lack of price data on their wider variety of goods and services means they cannot be estimated historically. In the period 2005–15 the welfare ratios of median income using the official poverty basket average 0.51 (compared with 1.44 for our basket), implying that a single median worker does not earn enough to take a family above the poverty line, while two median workers would just achieve it. This is consistent with the Mexican government's own estimates of income poverty, according to which just over half of the population was below the income poverty line in the years 1992–2014.[47]

V.   Short-run movements in living standards and inequality

A full account of how these findings intersect with the Mexican historiography is beyond the scope of this article, but we highlight key implications for the economic narrative. First, Mexican wage earners did not gain in material terms from independence from Spain, achieved in 1821.[48] The most extended periods of conflict (insurrection in the 1810s and the civil war from 1855 to 1867), sometimes compounded by agricultural crisis (in 1806–19 and the mid-1860s), were periods of sharp decline. In terms of inequality, y/w declined about 25 per cent from 1800 to 1860 due to falling GDP. Our data confirm some features of the revisionist economic history of this period that highlights the recovery of the economy after insurrection, the destructive nature of armed conflicts in this era, and a moderate reduction in inequality.[49]

Second, the dramatic growth between 1876 and 1910, fuelled by international lending, foreign direct investment, and exports, did not lead to any improvement in typical living standards (figure 3).[50] The doubling of per worker GDP combined with stagnating wages translated into a similarly dramatic rise in inequality.[51] In this sense Mexico fits the pattern of rising inequality in the US and Australia in this period discovered by Williamson.[52] Williamson argues that in the labour-scarce Anglo-offshoot countries this was due to immigration pushing down relative

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[46] Poverty data from http://www.coneval.org.mx/Medicion/Paginas/Evolucion_dimensiones_pobreza_1990_2015.aspx (accessed Feb. 2017), based on the Encuesta Nacional de Ingresos y Gastos de Hogares (National Survey of Household Income and Expenditure).

[47] The poverty rate averaged 52.7% over 1992 to 2014, with no consistent trend (using the 'patrimonio' poverty line for 1992–2006 and 'bienestar' poverty line, that described above, for 2008–14). Both lines are estimated for 2008–12 and are very close, suggesting they are reasonably comparable.

[48] On the rising degree of inequality under these circumstances, see Challú, 'Great decline'; van Young, 'Los ricos se vuelven más ricos'.

[49] Chowning, *Wealth and power*; Sánchez Santiró, 'El desempeño'; Tutino, *From insurrection to revolution*; Williamson, 'Five centuries'.

[50] See O'Rourke and Williamson, 'When did globalization begin?', for a discussion of globalization in the late nineteenth century. For additional discussion of rising inequality during the Porfirian period, see Gómez Galvarriato, *Industry and revolution*; Haber, *Industry and underdevelopment*; López-Alonso, *Measuring up*.

[51] Arroyo Abad and Astorga Junquera, 'Latin American earnings inequality', find no rise in inequality around 1900, where we do. This may be because before 1920 they estimate inequality between different wage earners only, excluding the rise in incomes of capitalists that is captured by the inverse Williamson ratio through GDP.

[52] Williamson, 'Globalization and inequality', p. 126.

wages. Mexico, in contrast, was not characterized by labour scarcity, and was not a major recipient of immigrants in this period, suggesting that forces other than the Heckscher–Ohlin model were at work.[53] It is more likely that growth in returns in the capitalist export sector were concentrated in few hands, and outpaced wages.[54]

Third, while we lack price data for the period of the Mexican revolution between 1910 and 1920, real wages in the decade following the revolution were little different from 1900–10. This supports the argument that the revolution did not transform the structure of the economy or of business, and that the most productive industries remained largely unscathed (even protected) from the armed conflict.[55]

Fourth, there was a notable jump in living standards up to 1940, seen in both the unskilled urban construction wage and in the minimum wage that was implemented from 1934. This is consistent with several independent studies, including a report by the General Motors Company for Mexico from 1942 that complained that real wages and benefits rose 44 per cent in dollar terms between 1935 and 1940.[56] This jump may have had partly political causes: the Cárdenas administration (1934–40), under pressure from the labour and agrarian movements, deepened land reforms and pushed for pro-labour resolutions to conflicts over wages and working conditions. Still, both real construction wages and the minimum wage rapidly fell back to previous levels by the mid-1940s, owing to high inflation.

Fifth, from around 1950 for the minimum wage, and a few years later for unskilled construction wages, living standards embarked on their most sustained rise in Mexican history. Data on heights support the finding that living standards rose, as those born in the 1930s and 1940s were taller than their predecessors, while the period of our highest welfare ratio coincides with the fastest growth rates of heights.[57] The period from the Second World War to the 1970s was marked by state-led development, rapid industrialization, and the historically highest rate of economic growth in Mexico; for these reasons it is known as Mexico's 'miracle' period. Protected and subsidized by the government, industry's share of employment rose from 12.7 per cent in 1940 to 23 per cent in 1970,[58] while per worker GDP grew at an average rate of 2.8 per cent through the 1970s. Real wages reached their highest level ever during this period, while inequality declined throughout the 1960s and early 1970s.

Data on land holdings suggest that land reform and the peasant economy also contributed to declining inequality from the 1930s. We find that the Gini coefficient for private and communal land holdings declined from 0.93 in 1930 to 0.82 in 1960, while the Gini for private land holdings fell from a peak of 0.96 in 1940 to 0.90 in 1970. We estimate that the economic yield of small *ejido* plots (less than five hectares) outpaced growth in GDP from 1930 to 1960, also supporting a decline in inequality.[59] Moreover, a set of rural subsidies raised the purchase prices of corn and other staples, lifting rural incomes.[60]

[53] Buchenau, 'Small numbers'.
[54] Coatsworth, 'Inequality'; Williamson, 'Five centuries'.
[55] Haber, Razo, and Maurer, *Politics of property rights*; Womack, 'Mexican Revolution'.
[56] Bortz and Aguila, 'Earning a living', p. 121.
[57] López-Alonso and Vélez-Grajales, 'Heights'.
[58] INEGI, *Estadísticas históricas*, tab. 5.6.
[59] Authors' estimates based on data in Solís, *La realidad económica mexicana,* ch. 4.
[60] Doroodian and Boyd, 'Impact'.

Our finding that growth was broadly inclusive during the 'Mexican miracle' mirrors findings for Uruguay and Chile in the same period,[61] but it is a key point of disagreement with much of the historiography for Mexico, which claims that inequality rose.[62] However, as we show in appendix I, this view is based on income distribution estimates that are not comparable over time; more consistent estimates imply no rise in inequality in this period. Our findings also stand in contrast to those of Arroyo Abad and Astorga Junquera, who find a peak in inequality in 1950. Their result appears to be driven by an outlier for the income of the richest group in 1950, which more than doubles relative to other groups compared with their estimates for 1940 or 1960. Our data have more uniform and local sourcing of the data, yielding more consistent estimates.[63]

Our findings suggest that the combination of developmentalist and redistributive policies ensured that wages tended to rise more closely with economic growth than in any other period of Mexican history. These policies are illustrated by the rise in the minimum wage seen in figure 1, and a rise in subsidies of basic goods aimed at keeping the cost of living relatively low.[64] This is not to deny the authoritarianism of the regime. Scholars have examined the complex relationship between state and labour in this period, highlighting the combination of intense social and labour mobilization, the state's co-optation and control of worker organizations, and state violence against recalcitrant actors.[65] Thus, while repression was common, we find that the broader economic bargain resulted in a measure of economic inclusion.

Sixth, the break point was around 1980, when wages were dealt a blow from which they have never recovered. Mexico experienced a currency crisis in 1976 and implemented an International Monetary Fund-supported adjustment programme over the years 1977–9.[66] The result was cuts to the real minimum wage, falling real wages, and rising inequality. The debt crisis of 1982 led to further and starker adjustment. Partly in response to the crisis, and partly as a conscious repudiation by the incoming administration of the preceding economic strategy,[67] the government withdrew its support for the political bargain of the previous decades, embracing liberalization, privatization, and deregulation. As part of a general fiscal adjustment, social spending was slashed.[68] The 1980s were famously a 'lost decade' for economic growth, with per capita GDP recovering its 1981 peak only in 1997. Per worker GDP, for its part, took more than 30 years to recover: it exceeded its 1981 peak only in 2015.

While the aggregate economy stagnated after 1980, urban unskilled wages declined dramatically, from a historical peak welfare ratio of 2.77 in 1978 to a trough of only 1.12 in 1990. The minimum wage moved in tandem with the actual

[61] Bértola, 'A 50 años de la curva de Kuznets'; Rodríguez Weber, 'Political economy'.

[62] Bortz, *Industrial wages*; Middlebrook, *Paradox of revolution*; Prados de la Escosura, 'Inequality and poverty in Latin America'.

[63] Arroyo Abad and Astorga Junquera, 'Latin American earnings inequality'. This article, as well as Astorga Junquera, 'Functional inequality', tab. B-5, does not give exact sources for the 1950 wage data, referring to a mix of sources from the following international organizations: International Labour Organization, Economic Commission for Latin America and the Caribbean, and Programa Regional del Empleo para América Latina y el Caribe.

[64] Ochoa, *Feeding Mexico*, pp. 1–3.'

[65] A good overview of the literature can be found in Hamilton, *Mexico*, chs. 3 and 5.

[66] Boughton, *Silent revolution*, pp. 282–3.

[67] Bruhn, 'Social spending'.

[68] Comision Economica para America Latina y el Caribe, *Equidad y transformación productiva*, p. 98, tab. IV-4.

wage until about 1990. After 1990 the minimum wage remained stable and low, but actual real wages and inequality were both volatile. Real wages dropped rapidly in the five years after the signing of NAFTA in 1994, but recovered equally rapidly. Over the period of more than two centuries, 1999 was the year of the highest inequality. In the same year the welfare ratio was 1.40, only 50 per cent higher than its nineteenth-century average of 0.91.

VI. Inequality and economic dualism

We cannot hope to explain all of the short-run variability discussed above, but we can provide an explanation of our key finding of a long-run divergence between wages and per worker GDP. To do so we present a simple dual economy model with a traditional sector and a modern sector. A dual economy model is consistent with the fact that an estimated 53.7 per cent of non-agricultural workers in Mexico were still employed informally in 2009.[69] The median worker is therefore plausibly within the traditional sector. On the other hand, construction in Mexico is a modern capitalist industry, and we find that the unskilled construction worker is consistently in the seventh or eighth decile in the 2005–16 period, earning on average 40 per cent more than the median.[70] Yet wages of unskilled workers in the capitalist sector suffered the same long-run divergence from productivity as the median worker in the informal sector. It is this long-run divergence that a dual economy model allows us to explain.

We assume that the traditional sector and the modern sector produce the same good. The traditional sector uses only unskilled labour at constant returns to scale. One feature of traditional dual-sector models such as those by Lewis and Kuznets is that they assume no productivity growth in the traditional sector.[71] This does not seem appropriate in most countries, which have seen at least some wage growth in traditional sectors.[72] In the case of Mexico, we saw above that the economic yield of small *ejido* plots outpaced growth in GDP from 1930 to 1960. So we allow technological improvements that benefit the traditional sector, indexed by A^T. This may reflect improved know-how, improved infrastructure such as roads and communications, or low-cost improved inputs such as better seed varieties in agriculture. Production in the traditional sector is:

$$Y_T = A_T L_T, \tag{1}$$

where L_T is unskilled labour employed in the traditional sector. The wage in the traditional sector is assumed to equal marginal (and average) product:

$$w = A_T. \tag{2}$$

[69] ILO, 'Statistical update'. By 2008 agriculture represented only 13% of the total workforce; INEGI, *Estadísticas Históricas*, tab. 5.10. As Lewis, 'Economic development', p. 142, noted, the traditional sector includes the range of casual urban workers from street traders to retainers, which form a large share of the informal workforce in Mexican cities, in addition to many rural workers.

[70] Using ENOE data. Moreover, over the same period, the 80th percentile of wage earners had on average only 12 years of education, implying no more than high school education, which we can plausibly interpret as unskilled.

[71] Lewis, 'Economic development'; Kuznets, 'Economic growth'.

[72] Gollins, 'Lewis model'.

The modern sector employs unskilled workers L_M, where $L_T + L_M = L$ is the total supply of unskilled labour. In addition it employs physical capital and human capital that we aggregate into factor K, denoted simply 'capital', all of which is owned by a minority of H elite workers.[73] This allows us to model the inverse Williamson ratio, which compares the unskilled wage to the returns on all factors of production, in contrast to the labour share, which aggregates unskilled and skilled labour in order to compare it with capital.[74] We assume a constant returns to scale neoclassical production function with Hicks-neutral technology A_M:

$$Y_M = A_M F(L_M, K) \tag{3}$$

Factor returns are equal to marginal product:

$$w = A_M F_L' \tag{4}$$

$$r = A_M F_K' \tag{5}$$

where w is the unskilled wage and r the return to capital, and F_p' is the partial derivative of F with respect to p. Per capita income for elite workers is rK/H, which we assume is greater than the wage w of unskilled workers.

We assume labour mobility between sectors—which we denote the Lewis assumption, following Lewis,[75] and discuss later—so the unskilled wage is equalized across the sectors:

$$w = A_M F_L' = A_T. \tag{6}$$

As long as there is production in both sectors, the modern sector employs unskilled workers up to the point that their marginal product equals A_T, and remaining workers are employed in the traditional sector. When is there production in both sectors? Let L_M^* be the level of employment in the modern sector such that:

$$A_M F_L' |_{L_M^*} = A_T. \tag{7}$$

If $L_M^* < L$ then $L_T > 0$ meaning production will take place in both sectors, with $w = A_M F_L' = A_T$. If, on the other hand, $L_M^* > L$, then the traditional sector disappears and $w = A_M F_L' > A_T$.

We can now derive the following proposition.

Proposition: As long as $L_M^* < L$, a rise in A_M or K will increase the inverse Williamson ratio y/w.

This follows from the fact that y is a weighted average of per worker GDP in the traditional sector, which is $y_T = A_T/L_T$, and per worker GDP in the modern sector $y_M = Y_M/(L_M + H)$, where $L_M + H$ is the total number of workers in the modern sector. By assumption, output per worker is greater in the modern sector than in the traditional sector. A rise in A_M or K both increases y_M and draws more workers into the modern sector, raising aggregate output per worker. Since $w = A_T$ is constant,
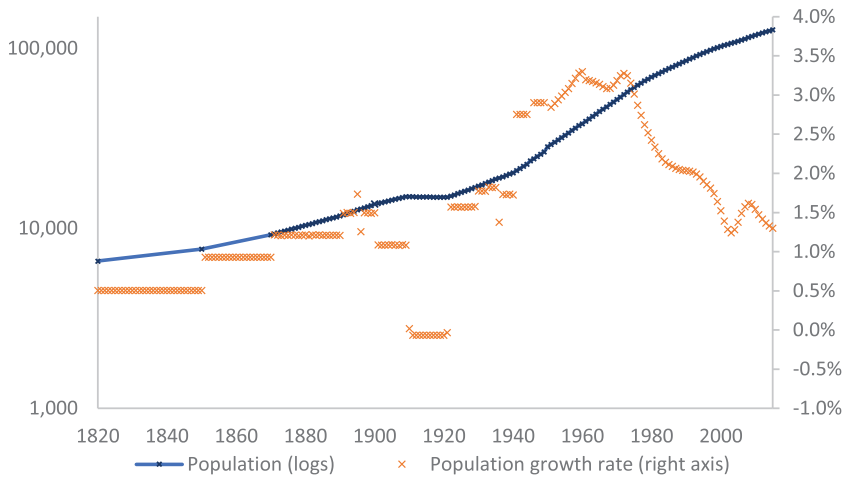
Figure 4. *Population level (in thousands) and growth rate, 1820–2015*
[Colour figure can be viewed at wileyonlinelibrary.com]
Sources: 1820–1959: Bolt et al., 'Maddison Project database'; 1960–2015: World Bank, 'World Development Indicators'.

the ratio y/w rises. Thus technical progress in the modern sector, or a rise in the quantity of human or physical capital, will increase the inverse Williamson ratio as long as there is sufficient unskilled labour L to maintain production in the traditional sector.

We can now explain the long-run divergence between unskilled wages and per worker GDP that we find in the data for Mexico: L_M^* remained below L throughout, and from the nineteenth to the twenty-first century, a slow rise in productivity in the traditional sector led to a doubling of unskilled wages A_T. Meanwhile, a combination of human and physical capital accumulation and technical change in the modern sector led to substantially higher increases in output per worker in that sector, and hence in per worker GDP.

Why did L_M^* remain below L? The most straightforward explanation is the rapid rate of population growth, shown in figure 4. From 1913 to 2000 the Mexican population grew by a factor of 6.7, double the global population growth of 3.4.[76] Mexico's population growth rate exceeded 2.5 per cent from 1940 to the mid-1970s, peaking in 1960 at 3.3 per cent; by 2000 it had fallen to 1.5 per cent, still higher than western Europe's mid-twentieth-century rate of 1 per cent. Gómez Galvarriato and Silva Castañeda argue that this explains much of why Mexico's per capita GDP fell behind that of Spain after 1960; our findings suggest that it also helps to explain why wages fell so far behind GDP.[77]

We can now explain why Mexico did not follow the Kuznets process. Kuznets's seminal model of the relationship between inequality and economic development also assumes a dual economy. However, unlike in our model, he assumes that when the modern sector enjoys technical progress, unskilled workers within that

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[76] Bolt, Inklaar, de Jong, and van Zanden, 'Maddison Project database'.
[77] Gómez Galvarriato and Silva Castañeda, 'La divergencia económica'.

sector also enjoy rising wages, diverging from those in the traditional sector.[78] This implies a lack of mobility between unskilled workers in the traditional sector and in the modern sector, requiring some institutional, geographical, or legal barriers. Without such barriers, unskilled wages in the two sectors could not diverge in the way he assumes. In contrast, our use of what we called the Lewis assumption of free mobility drives our finding that unskilled wages do not rise when the modern sector grows.[79]

To analyse the implications of the two assumptions, we augment the model by distinguishing between unskilled wages in the modern sector w_M, and unskilled wages in the traditional sector w_T. As we argued above, they are plausibly represented by urban construction workers' wages, and median income, respectively. The results of the model are unchanged if we assume a static wedge between the two types of wages.[80] This is what is implied by the Lewis assumption: the two wages may differ, but their ratio is constant. Under the Kuznets assumption, on the other hand, they can diverge.

Now suppose there is economic development in the sense of technical change or capital deepening in the modern sector. Under the Lewis assumption, this will lead to a rise in unskilled employment in the modern sector L_M until its marginal product is equalized with that in the traditional sector, A_T. Thus unskilled wages remain constant. Under the Kuznets assumption, mobility constraints imply that L_M does not increase by this much, so the marginal product of unskilled labour in the modern sector rises above that in the traditional sector, with wages in the modern sector rising to $w_M' > w_T$.

We illustrate using Lorenz curves in figure 5. For simplicity we assume an initial position in which $w_M = w_T$. 'Other factors' include human and physical capital owned by an elite who by assumption have higher incomes than unskilled workers and therefore form the rightmost segment of the Lorenz curve. Under the Lewis mobility assumption, as in our model, unskilled wages remain constant while the incomes of other factors rise. This implies a shift downwards in the Lorenz curve, so inequality rises. Under the Kuznets immobility assumption, incomes of unskilled workers in the modern sector rise.[81] While it too implies an unambiguous rise in inequality, the new Kuznets Lorenz curve must be strictly above the Lewis Lorenz curve, implying a smaller rise in inequality than under the Lewis assumption.[82]

[78] Kuznets, 'Economic growth', pp. 12–16. Anand and Kanbur, 'Kuznets process', analyse what they call the 'Kuznets process' more generally, but also assume that within-sector distributions remain constant, implying that technical progress in the modern sector raises wages in that sector. Kuznets, 'Economic growth', p. 17, mentions the possibility of *declining* inequality within the urban sector, the opposite of Lewis's assumption, but this is not in the model he presents.

[79] As far as we can tell, this key difference between the Lewis and Kuznets models has not previously been recognized, and some authors even conflate them in a single 'Kuznets-Lewis' model; for example, Bourguignon, 'Development and inequality'; Arroyo Abad and Astorga Junquera, 'Latin American earnings inequality'.

[80] Gollins, 'Lewis model', p. 78, notes dualist models should not be taken to imply that all traditional sector wages are identical. In our case, differences could be due to compensating variations across different activities within a sector, for instance if construction is a dangerous activity; or they could be due to efficiency wages in the modern sector, as in Temple, 'Dual economy models'.

[81] In the figure we assume, like Kuznets, that inequality within the modern sector stays constant, so unskilled wages within the modern sector rise at the same rate as incomes to other factors. Our result differs from the classic inverse-U of the 'Kuznets curve', as formalized by Anand and Kanbur, 'Kuznets process', in part because of the existence of other factors of production that form the third segment the Lorenz curve.

[82] This follows from the fact that the move from the Lewis case to the Kuznets case is a Pigou–Dalton transfer from richer other factors to (a proper subset of) poorer unskilled workers.
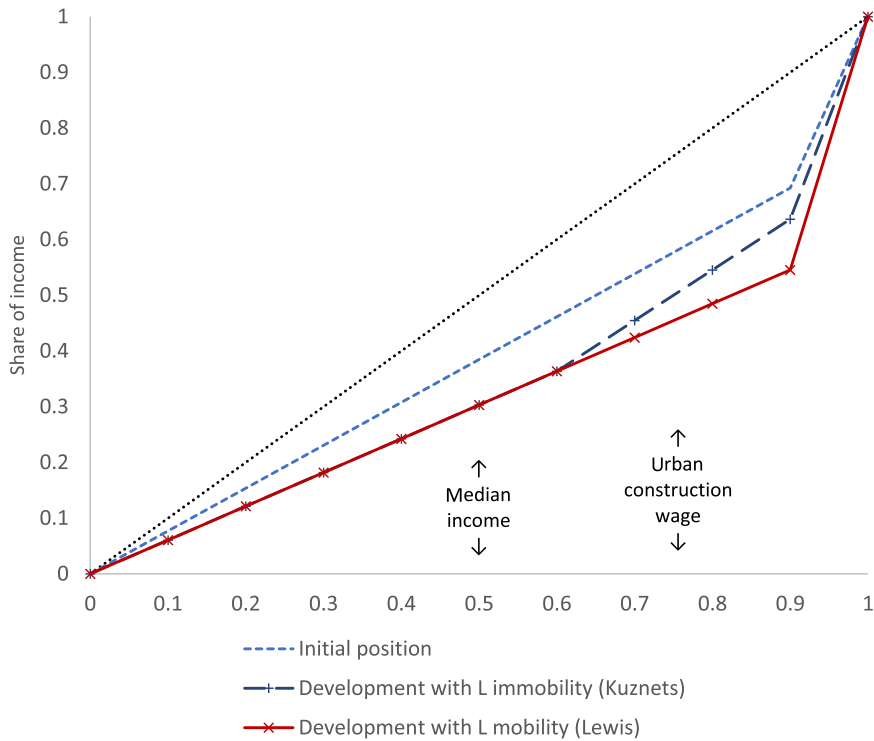
Figure 5. *Lorenz curves for development under Kuznets and Lewis assumptions [Colour figure can be viewed at wileyonlinelibrary.com]*

Note: The 45-degree line shows perfect equality. Unskilled workers form 0.9 of the population. 0.1 of the population own other factors (high skill labour and capital) and have higher per capita incomes. The initial position shows the economy with all unskilled workers paid the same. 'Development' signifies productivity growth in the modern sector. Under the Lewis assumption, only other factors benefit from this growth. Under the Kuznets assumption, this growth is divided proportionally between other factors and those unskilled workers that are in the modern sector. Thus under the Kuznets assumption, wages of unskilled workers in the modern sector grow faster than aggregate productivity, and diverge from the median wage.

How does the ratio y/w_M evolve? Under the Kuznets assumption, unskilled wages in the modern sector rise at the rate of productivity growth in the modern sector, which is *higher* than the rate of aggregate productivity growth (which includes the traditional sector). Thus y/w_M declines. As we have seen, this is inconsistent with the Mexican data. Instead, the fact that w_M and w_T do not diverge, but y/w_M rises, supports the Lewis mobility assumption.

The ethnographic, historical, and sociological literature of twentieth-century Mexico provides direct evidence for the assumption of mobility between the formal and informal sectors. In 1945, the National Federation of Small-Scale Vendors and Industrialists was demanding protection from 'the disadvantageous competition from a floating mass of more than one hundred thousand maladjusted workers, who one day are garbage pickers or porters, and another [day] penny-vendors of fruit and trinkets'.[83] More than a quarter of construction workers in Mexico City in the 1970s still owned land in the countryside, and they perceived construction work

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[83] Bleynat, 'Business of governing', p. 8.

as a gateway from the subsistence to the capitalist sector.[84] Ethnographies of the Mexican poor similarly provide qualitative evidence of fluid boundaries between the peasant and urban, and informal and formal, sectors throughout the second half of the twentieth century, while household survey data give quantitative support to the claim that workers move frequently between formal and informal employment and self-employment.[85]

VII.   Conclusion

Long-run wage series have allowed us to study both economic welfare, and the process of economic development that explains its evolution. We have argued that the wages of unskilled urban workers engage with dualist models of economic development, while national median income is more informative for economic welfare and representative living standards. In the case of Mexico, both these series followed a similar path, arriving in the twenty-first century at about double their nineteenth-century level. Given that GDP per worker rose more than eight times over the same period, this represents a remarkable increase in inequality. Indeed, the fact that unskilled urban construction wages remained above the median through to the twenty-first century is itself a sign of the limits of Mexican development.

Our explanation for these long-run trends is a simple model of the dual economy, in which unskilled workers are mobile between traditional and modern sectors, and rapid population growth prevents the absorption of all workers into the modern sector. A modest quantity of broad-based technical progress and infrastructure investment that benefited the traditional sector led to the small rise in wages that we observe, while competition between workers in the traditional and modern sectors prevented unskilled wages from rising with the more rapid rate of growth of the modern economy. The implied divergence between unskilled wages and productivity in the modern sector is inconsistent with Kuznets's model of inequality. Moreover, both qualitative and quantitative studies contradict his implicit assumption that barriers prevent unskilled workers in the traditional sector from competing with their counterparts in the modern sector. Lewis's assumption of mobility and competition for labour between these sectors, in contrast, helps explain these findings.

If the long-run trajectory was determined by economic dualism, however, over shorter periods shifts in the structure of power, and in political bargains, appear to have had a notable impact on incomes and inequality. The popular insurgencies of the 1810s and 1910s had uncertain effects in the short term, yet in both cases inequality declined afterwards. In particular, political and social dynamics changed profoundly in the decades after the Mexican Revolution (1910–20), leading to the rising power of agrarian, labour, and popular organizations. This laid the foundations for a development model and political arrangements that supported economic growth and raised wages from the 1950s. Given similar recent

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[84] Germidis, *Construction industry*. Fifteen per cent were *ejidatarios* (that is, they had rights to communal lands created by land reforms following the revolution), while 13% owned private small-holdings. See also Ball and Connolly, 'Capital accumulation'.

[85] Lewis, *Life in a Mexican village*; Lewis and Beltrán, *Pedro Martínez*; Hellman, *Mexican lives*. For research based on household surveys, see Maloney, 'Informality'. While Maloney presents this finding as contradicting the 'dualistic view', we explain that it is consistent with, and even required by, Lewis's version of dualism.

findings for mid-twentieth-century Chile and Uruguay, this may be an under-appreciated regional pattern.[86] In Mexico the basis of that model was not a western-European-style welfare state, but a *sui generis* combination of land reform, minimum wages, and subsidies. Instead of social democracy, this was a regime that combined authoritarianism with relatively inclusive economic policies. After the end of the 1970s it was not economic crises *per se* that caused inequality to rise to historically unprecedented levels, but rather the political reaction that unravelled the developmental and distributional model of the mid-twentieth century.

Most historians of economic development recognize that there are times when majorities suffer, rather than benefit, from the process. The optimists do not deny these periods, but believe that in the long run, economic forces lead to sustainably rising living standards and falling inequality. In contrast, more pessimistic scholars from Lewis to Piketty have argued that the dynamic of capitalist growth is primarily to increase inequality—which may be kept in check by crisis, or by state action in response to political pressures. In the US, the last third of the twentieth century called into question the standard assumption that productivity growth automatically raises living standards.[87] Our findings question whether this standard paradigm applies even over a much longer period in the case of Mexico. Two centuries of independence and more than a century of capitalist development have translated into remarkably little economic benefit for the majority of Mexicans.

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[86] Bértola, 'A 50 años de la curva de Kuznets'; Rodríguez Weber, 'Political economy'.
[87] Dew-Becker and Gordon, 'Productivity growth', p. 68.

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Appendix I: Robustness to alternative data

In this section we show that our main results are robust to comparisons with plausible alternative datasets. We discuss alternative sources for GDP in the nineteenth century, Gini coefficients from 1950 to 1977, and wages from the mid-twentieth century.

GDP in the nineteenth century

We use estimates of GDP up to 1877 due to Coatsworth, while for 1895 to 1970 they are due to the Banco de Mexico.[88] Sanchez Santiró provides estimates for a different set of years from Coatsworth, 1800–77, but their average level is virtually identical.[89] However, where the Coatsworth and Banco de Mexico estimates overlap, in 1895 and 1910, Coatsworth's estimates average only 78 per cent of the value of the Banco de Mexico's estimates. This suggests that our series up to 1877 may be underestimated relative to later values, implying that inequality up to 1877 would also be underestimated. This would imply an even greater rise in inequality than we report. Arroyo Abad and van Zanden estimate GDP per capita in Mexico up to 1800. Their 1800 estimate is just over PPP\$800 (1990 PPP\$, about 7 per cent below Coatsworth's estimate of PPP\$755 (1990 PPP\$).[90] Thus using their estimate for 1800 would not materially change our findings.

Alternative inequality estimates, 1950–77

Estimates of inequality have been produced for several years in the period 1950–77, before the establishment of the ongoing household survey ENIGH in 1984 and

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[88] Coatsworth, 'Inequality', p. 547; INEGI, *Estadísticas históricas*.
[89] Sánchez Santiró, 'El desempeño'.
[90] Arroyo Abad and van Zanden, 'Growth', p. 1206.

the occupation and employment surveys ENEU and ENOE from 1987. These early estimates were analysed by Bergsman and by Altimir.[91] Both point out serious problems of comparability between the different sources over time. Altimir notes out that the different years' data were collected by different organizations following different protocols.[92] They are not all defined using the same distribution. Such differences can lead to large spurious differences in measured inequality.[93] One indicator of problems of comparability is that the different years underestimate total household income relative to national accounts (NA) estimates by very different amounts. Bergsman reports that total incomes reported in the surveys for 1963 and 1968 are 80 to 82 per cent of NA estimates, while the surveys for 1975 and 1977 are 56 to 58 per cent of NA estimates.[94]

Different authors make different adjustments to the raw data in order to account for these and other differences in the underlying data, but none can be considered definitive. Altimir's figures are the only ones to use a consistent methodology throughout the period, and even so the author notes they should be treated with caution. Like Bergsman, he finds that estimates by other authors are arbitrary and inconsistent and not appropriate for making comparisons over time. This includes the estimates referred to by Bortz and by Middlebrook to support their claim that inequality rose in this period.[95]

Figure A1 plots Altimir's estimates of the Gini coefficient alongside our estimates of y/w. In Altimir's estimates there is a temporary upward spike in 1975, reversed in 1977, but Bergsman points out that 1975 was a smaller and less well executed survey relative to other years and concludes that 'the drastic changes implied by the 1975 results were probably in small part actual but short-run, and in large part due to errors in the survey'.[96] Overall, there is no clear trend in the Gini estimates and no evidence that inequality rose over the period 1950–77. This is consistent with our finding that there is no trend in y/w over the period.

Alternative inequality estimates, 1980–2015

We compare our measure of inequality with the most common measure of inequality, the Gini coefficient, for the recent period. Figure A2 plots the Gini coefficient for income reported by the Luxembourg Income Study (LIS), which uses the household survey ENIGH, along with our measure of inequality y/w for urban construction workers based on ENEU/ENOE (as in our main calculations), and for comparison y/w calculated from ENIGH. The main difference is the timing and magnitude of the rise in inequality in the 1990s. Otherwise they show similar trends: a substantial rise in inequality leading up to the late 1990s, and a decline in the early years of the twentieth century—although it may have returned to a rising trend in recent years. It is notable that inequality as measured by y/w is much higher in most years using ENIGH than using our preferred source ENEU/ENOE. Thus ENIGH would imply an even more extreme long-run rise in inequality than in our main estimates.

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[91] Altimir, *Distribución del ingreso*; Bergsman, 'Income distribution'. Székely, 'Pobreza y desigualdad', combines Altimir's estimates with ENIGH data to produce a series for the period 1950–2004, but acknowledges the comparability problems analysed by those authors.

[92] Altimir, *Distribución del ingreso.*

[93] For instance, Atkinson and Brandolini, 'Promise and pitfalls', demonstrate that estimates of the Gini for the Netherlands in 1991 vary by more than 4.5 Gini points depending on the source and the definition of the underlying distribution (read from their fig. 2, p. 779).

[94] Bergsman, 'Income distribution', tab. 5.

[95] Middlebrook, *Paradox of revolution,* cites income shares for 1950 and 1968 from de Navarrete, 'La distribución del ingreso', and Felix, 'Income distribution trends'. Bergsman, 'Income distribution', explains that de Navarrete and Felix use inconsistent methods of adjustment, exacerbating the existing underlying problems of comparability. Bortz, *Industrial wages,* relies on the same set of estimates (including Ginis reported by van Ginneken, *Socio-economic groups,* who himself relies on Navarette) and also switches sources and hence methods over time, similarly reducing comparability.

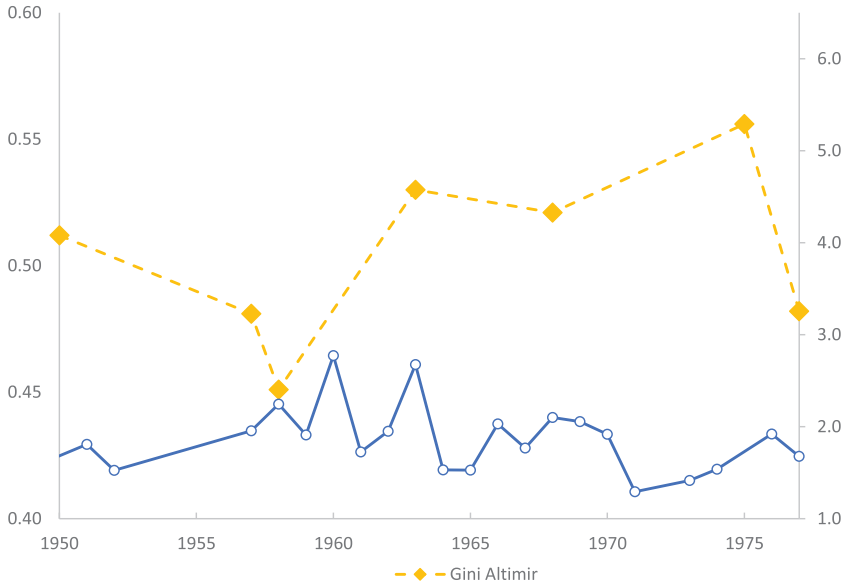[96] Bergsman, 'Income distribution', p. 17.

Figure A1. *Comparison of alternative inequality estimates, Gini coefficient (left-hand axis) and y/w (right-hand axis), 1950–77*
[Colour figure can be viewed at wileyonlinelibrary.com]
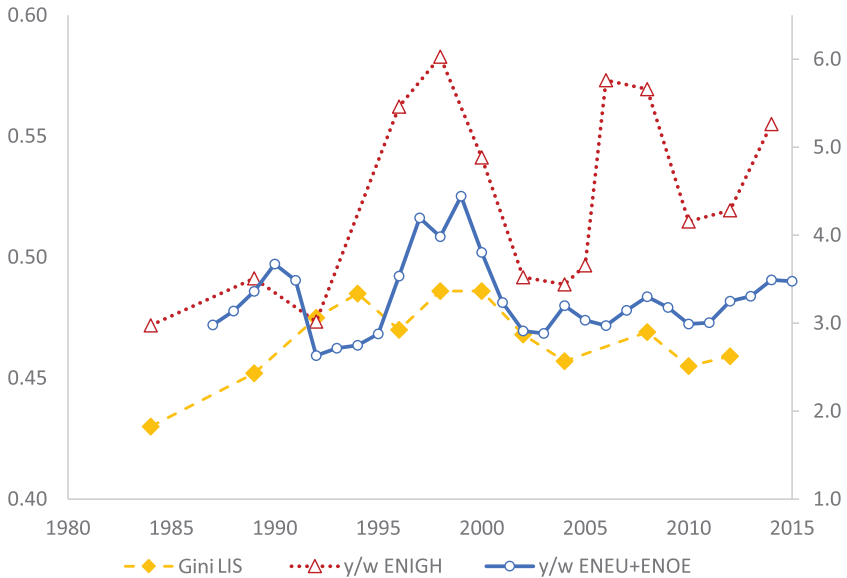*Source:* Altimir, *Distribución del ingreso*, for Gini coefficients; fig. 2 for *y/w*.

Figure A2. *Comparison of alternative inequality estimates, Gini coefficient (left-hand axis) and y/w (right-hand axis), 1984–2015*
[Colour figure can be viewed at wileyonlinelibrary.com]
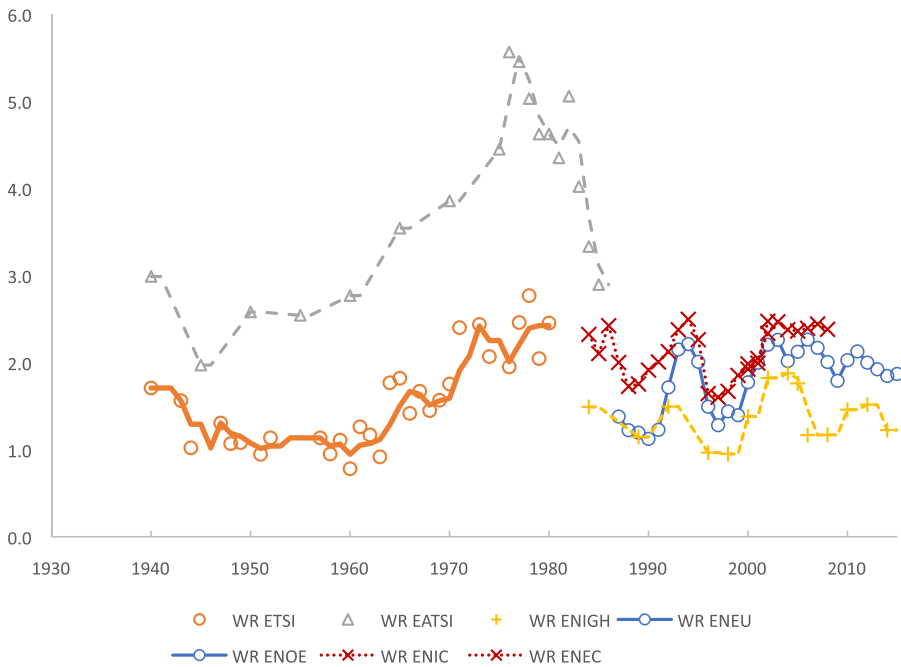*Sources:* LIS, 'Inequality'; see online app. S1 for the other sources.

Figure A3. *Comparison of alternative wage sources, in welfare ratios, 1939–2015 [Colour figure can be viewed at wileyonlinelibrary.com]*

Notes: Different series apply to different sets of workers, as described in app. 1. Our primary series in fig. 1 is ETSI, extended to 1985 using EATSI growth rates, followed by ENEU and ENOE. For ETSI, EATSI, and ENIGH, the lines are moving averages. *Sources:* See online app. S1. ENOE is the successor to ENEU and is plotted in the same symbology. The same applies to ENEC and ENIC.

Alternative sources for wage data from the mid-twentieth century

Wages from 1987 to 2015 are from household employment and occupation surveys, but there are also industrial surveys for the later period, the Encuesta Nacional de la Industria de la Construcción (ENIC) for 1984–2002 and Encuesta Nacional de Empresas Constructoras (ENEC) for 2000–8.[97] They do not provide data specific to Mexico City or its environs but do provide national-level data. Figure A3 plots the welfare ratio using these data, alongside our preferred series, including the 1939–85 data. They are noticeably higher than our preferred ENEU/ENOE series during the 1980s, but they are extremely close from 1992 onwards. We also plot the EATSI (Encuesta Anual de Trabajo y Salarios Industriales) series for all industrial workers in the Federal District in the years 1939–85, alongside the ETSI data for just unskilled construction workers in the same zone, for comparison.

There are other sources we can also use for comparison with the construction wage. Over the 1820s to the 1850s, our series was near the bottom of the urban male pay scale, 15 per cent below male textile mill workers, and a third higher than those of female cooks.[98] At the beginning of the twentieth century, our series is almost at parity with workers in the textile industry of Orizaba, Veracruz, in the 1900s and 1910s. In the 1920s Mexico City construction wages slid relative to Orizaba's (from 95 to 67 per cent),[99] probably as a result

[97] INEGI, *Estadísticas históricas*, tabs. 6.156 and 6.157.
[98] García Luna, *Los orígenes de la industria*, p. 29; Bazant, 'Evolution'; Archivo Histórico del Distrito Federal, Ayuntamiento, vols. 508 (no. 6), 2300 (no. 20), 2304 (no. 32), 2305 (no. 110), 2306 (no. 14), and 2307 (no. 71).
[99] Gómez Galvarriato, *Industry and revolution*.

of improvements in the labour conditions of the textile industry after the first collective bargaining agreements.

Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Supporting Information
Supporting Figures