Inequality, Living Standards and Growth: Two Centuries of Economic Development in Mexico

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Abstract

Historical wage and incomes data are informative both as normative measures of living standards, and as indicators of patterns of economic development. We show 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 a new dataset including both series in Mexico from 1800 to 2015 and find that both have historically failed to keep up with aggregate growth: per worker GDP is now over eight times higher than in the nineteenth century, while unskilled urban real wages are only 2.2 times higher, and median incomes only 2.0 times. 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 consistent with a dual economy model based on Lewis's assumption of a reserve army of labour, and explain why Kuznets's predicted decline in inequality has not occurred.

Key words: Inequality, living standards, Kuznets curve, Mexico

JEL codes: D31, N36, O15

1. Introduction

It 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 to 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 also tell us about economic structure, allowing us to test competing models of economic development.

The goal of this paper is to estimate economic welfare and inequality in Mexico from the nineteenth century to the present using new long-run data series on real wages and incomes, and to use them to explore the process of development. We estimate a series for 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 (1997) 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 is this ratio, the less GDP growth contributes to social welfare.

The standard reference for the study of long-run trends in inequality remains Kuznets (1955) (e.g. Piketty 2014, Milanovic, 2016). Where 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

[1] Lucas (1988: 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.’
[2] Prados de la Escosura’s (2008).
[3] 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.

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 Lewis's (1954) assumption of mobility between sectors is more plausible.[4]

Our interest in median and unskilled urban wages places our focus in between that of studies of very rich, as in the recent literature on top incomes,[5] and studies of the very poor. These approaches are complementary: as Piketty (2014, p. 266) 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.' Like Tawney (1913, p.7) 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.'

Our findings therefore speak to the underlying question of whether economic growth automatically leads to rising living standards for all, or whether it is consistent with stagnating living standards for a majority and an increasing concentration of income. The optimistic view is expressed by Clark (2009, p 2-3), who argued that, in today's rich countries, productivity trends have implied that 'The biggest beneficiary of the Industrial Revolution has so far been the unskilled.' Offering a contrasting view, Piketty (2014) 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 of the mid-twentieth century.[6] 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 8.5 times. Thus Mexico supports the pessimists' view of long-run trends in inequality.

The next section discusses the literature on long-run inequality, with a focus on Latin America. Section three describes our data on real wages and median income. Section four explains how our measure speaks to the normative interpretation of inequality. Section five presents our main results. Section six considers the implications of the short-run movements in living standards and inequality for existing historical narratives of Mexican development. Section seven provides a simple dual economy model that can explain the observed long-run trends in inequality and living

[4] Thus we follow Ahluwalia's (1976, p. 307) advice that in testing the Kuznets curve, 'such processes should be examined in an explicitly historical context for particular countries.'
[5] See the World Wealth and Income Database [http://wid.world/] for available top income data and a full list of literature and sources.
[6] Scheidel (2017) similarly argues that inequality has historically declined only as a result of major crises.

standards, and which we use to explain why Kuznets's assumption is not upheld in the case of Mexico.

2. Histories of inequality and living standards

The historical approach to the study of inequality follows the tradition of Kuznets's (1955), Atkinson and Harrison (1978) and Piketty (2014).[7] Kuznets (1955) 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 to both 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 (2016) generalized the Kuznets curve into what he calls 'Kuznets waves' to explain continuing changes in inequality.

Following in the footsteps of Kuznets, and Atkinson and Harrison, Piketty's (2014) explanation of inequality trends depends on both economic and non-economic mechanisms. He shows that while the accumulation of capital follows an economic logic, the Great Depression and the World Wars dealt a great blow to 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 the English-speaking countries.

These authors focused on today's rich countries. Turning to Latin America, Engerman and Sokoloff (1997) argued 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 (2012) further developed the view that economic growth depends in large part on the inclusiveness of political institutions. Reygadas (2010) highlighted 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.

Other scholars have questioned the assumption that Latin America has always been one of the world's most unequal regions. Williamson (2010) estimated 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

[7] Also see Piketty (2003, 2011), Piketty and Saez (2003), Banerjee and Piketty (2005), Piketty, Postel-Vinay and Rosenthal (2006), and Atkinson and Piketty (2007, 2010).

up to the nineteenth century and probably declined from *circa* 1790 to the mid nineteenth century, as most of Latin America achieved independence.[8] Inequality surged in the first globalization around 1880-1914, driven by the rise in the terms of trade that benefitted a small elite of landowners and capital owners.[9] 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 (2017) finds that inequality fell over 1940-1970 in Chile, driven by political forces, while Bértola (2005) finds a similar pattern in Uruguay.[10]

For the case of Mexico, three papers present long run series of inequality through the twentieth century, all in the context of multi-country studies. Frankema (2010) 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. Other works place the inequality peak in the mid twentieth century. Prados de la Escosura (2007) 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. He finds that inequality peaked in 1960. Similarly, Arroyo Abad and Astorga (2017) estimate the between-group Gini coefficient for three types of workers and the group 'employers, managers and professionals' from 1820 to 2000. 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 6.

The study of living standards over time has benefited from recent innovations in the economic history of real wages, led by Robert Allen's studies of real wages in Europe, Asia and the Americas (Allen 2001; Allen, Murphy and Schneider 2015). Allen established a simple methodology that allows long-term comparisons by estimating annual income from daily wages of unskilled construction workers, calculating the cost of living as a Laspeyres price index for a basic subsistence basket.[11] This approach was used for several Latin American countries by Arroyo Abad and Van Zanden (2015) up to 1800. Challú and Gómez-Galvarriato (2015) focused on Mexico from 1730-1930, finding cycles of real wage gains and losses up to 1930 with no apparent long run trend. Other studies have used consumer price indices. Bortz and Aguila (2006) provide a comprehensive summary of thirty studies

[8] Consistent with this, Dobado and García (2010) find that real wages in mining were medium-to-high in Mexico over 1800-1820, and that inequality was relatively low by international standards.
[9] This interpretation is originally in Coatsworth (2008).
[10] For a roadmap to the recent literature on historical Latin American inequality other than Mexico, see Bértola and Williamson (2017).
[11] The method has been criticized for its use of simplified consumer baskets as well as assumptions on the size of households and number of days worked in a year (Dobado 2015; Humphries and Weisdorf, 2016). Still, the assumptions hold well against the evidence existing for the case of Mexico and Latin America (Allen, Murphy and Schneider, 2015; Challú and Gómez-Galvarriato, 2015).

of real wages in twentieth century Mexico, finding expansions in the postrevolution and in the postwar periods, and contractions in the early 1940s and from the 1980s. Overall, they find that the average Mexican worker did not make gains in living standards over the twentieth century.

3. Data

One of the contributions on this paper 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.[12] Appendix 1 discusses the implications of alternative GDP data and wage data sources. Detailed sources and methodology are described in Appendix 2.

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 to 1930, the data are based on Challú and Gómez-Galvarriato (2015), who compiled daily wage rates from the payrolls of construction sites in public institutions. From 1940 to 1980 the data are from the Survey of Industrial Work and Salaries (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 (for 1987-2004) and ENOE (for 2005-2015).[13]

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 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 2005-2015. The use of censuses and

[12] 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. Regarding changes over time, estimates of the working population in Estadísticas Historicas de México over 1921 to 1960 vary from 0.53 to 0.62 of the working-age population (with no trend), implying variation of up to 17 percent. This could be interpreted as a margin of error for estimated changes over time.

[13] We use ENEU and ENOE rather than the commonly-used survey ENIGH 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. Real wages of construction workers are on average 25 percent lower in ENIGH than in ENEU and ENOE, implying even less growth in living standards than in our preferred data. See Appendix 1 for estimates using ENIGH.

surveys is straightforward in that they report frequencies by income brackets 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 Appendix 2 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 (as in Arroyo-Abad and Astorga 2017 and Astorga 2015), it has the advantage that it uses 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 (2008, pp. 292-3) finding for Spain, in Mexico the unskilled construction wage did not fall behind median income. Indeed, for all the years in which we have data over 1800-2015, the unskilled urban wage was between 12 percent and 53 percent higher than median income with no apparent trend, except for two outliers: in 1950 it was 17% lower, and in 1929 it was 79% 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 7.

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. We estimated a new consumption basket post-1930 to link to Challú and Gómez-Galvarriato's (2015) pre-1930 *respectable* 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.[14]

We do not presume that this measure of living standards fully reflects well-being. First, it does not capture all household income. The modern surveys confirm that for households with a construction worker, this worker's wage is typically the primary source of income, comprising on average 58% of total household income. We do not attempt to measure the remaining 42%, nor to divide household income by equivalent adults. Our measure also excludes benefits in kind that are provided by the government. Scott (2013) estimates that in 2010 the fifth and sixth deciles of the income distribution received public services worth respectively 17.5 and 21.1 percent of market income. 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

[14] 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.

standards not accounted for by real wages. Moreover, 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.[15] 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.[16]

4. 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 (1920) argued that inequality matters because of what it tells us about the amount and distribution of 'economic welfare'. Atkinson (1970) 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, than unequally.[17]

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" individual or household'.[18] Thus we interpret the inverse Williamson ratio using Atkinson's normative insight: the higher is the ratio, the less efficiently does aggregate productivity translate into our objective function of median income.[19]

How does our measure compare with the functional distribution of income, as analysed e.g. by Angeles (2008)? 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*

[15] López-Alonso and Vélez-Grajales (2017). Campos-Vazquez et al (2017) also find that literacy rates, school enrolment rates, and the number of physicians per head of population rise throughout 1895-2010.
[16] See Deaton (2006) for discussion of the causes of improved health over time.
[17] Atkinson 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.
[18] Joseph E. Stiglitz, Amartya Sen, and Jean-Paul Fitoussi (2009, pp. 13-14). Cowell and Flachaire (2017) and Aaberge and Atkinson (2013) also stress the normative significance of the median.
[19] 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.

labour.[20] Consider the following two cases. Dew-Becker and Gordon (2005, p. 125) find that in the US from 1966 to 2001, the bottom 90 percent of the income distribution saw income growth lower than the rate of economy-wide productivity growth, with some parts seeing no growth at all. Only the top ten percent gained more. Yet this was also a period in which the labour share *increased*,[21] 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 ten percent was due to labour income: inequality rose *within* labour, not *between* labour and capital. Similarly, Atkinson (2009) finds in the case of the UK that the overall wage share was virtually unchanged over 1954 to 2006, but that the income share of the bottom 50 per cent of wage earners fell by one fifth. 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 is the rate at which productivity benefits the typical worker.

5. 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, i.e. 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 discuss below, median income is theoretically of more normative relevance. Figure 1 includes the welfare ratio of the minimum wage in the Federal District, which came into force in 1934.

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 the 1990s 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

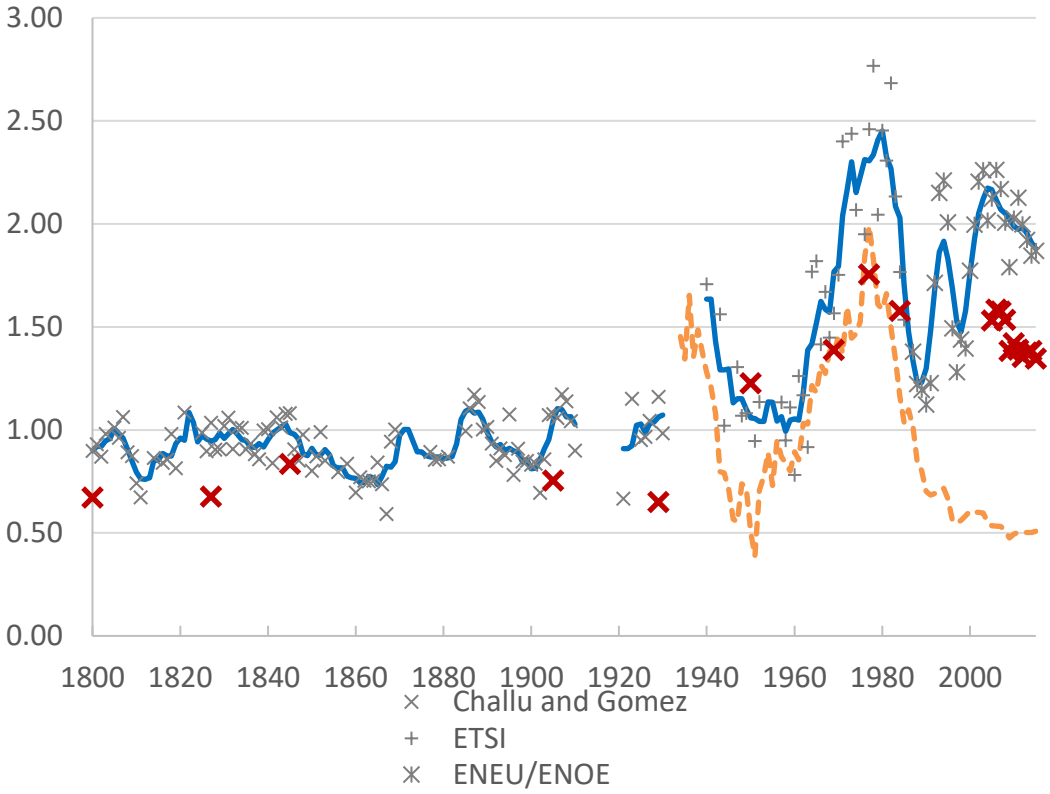
[20] Stiglitz Commission (pp. 13-14). Another reason is that it ignores the joint distribution of wages and capital income – what Milanovic (2019) refers to as the degree of homoploutia, or the extent to which it is the same households that receive high labour incomes and high capital incomes (see Ranaldi 2019 for a formal analysis).

[21] 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, September 16, 2019.

(owing to low per worker GDP[22]) 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 welfare ratio of the 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 4 over the period. In Mexico, the typical worker benefitted remarkably little from two centuries of economic development.

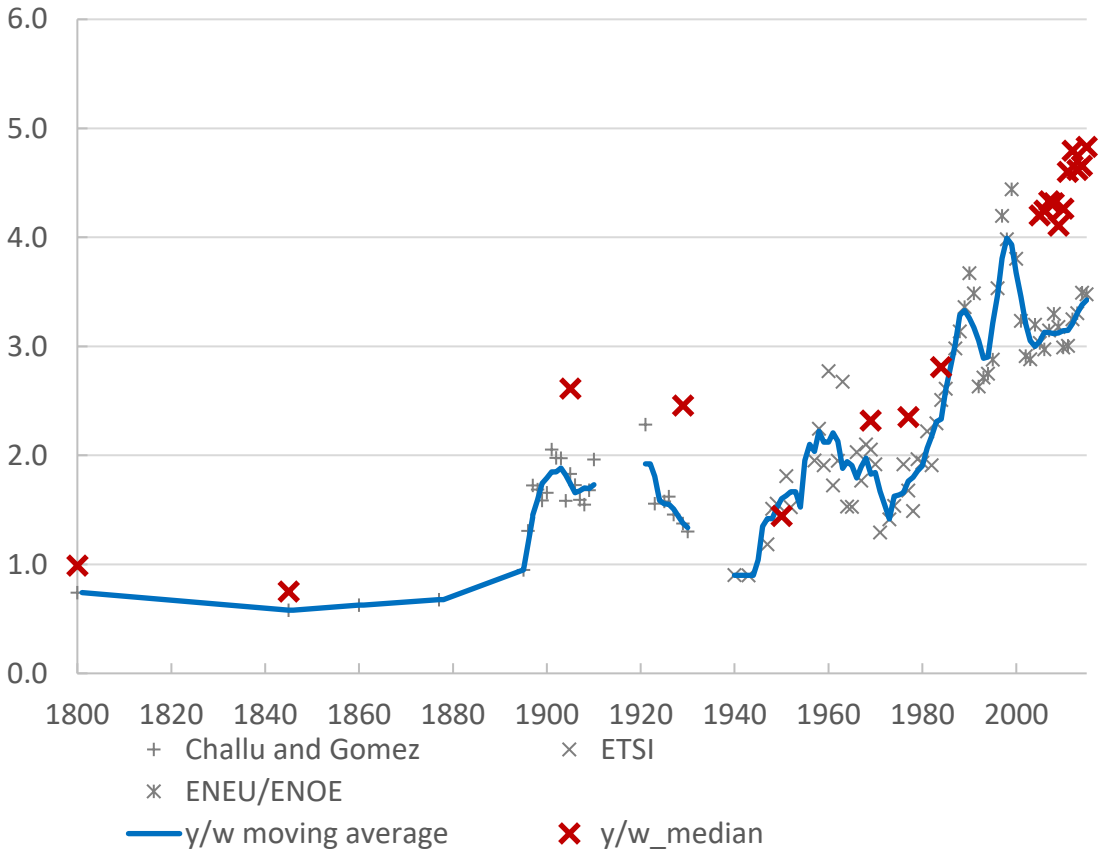
Figure 1: Living standards in Mexico: Welfare ratios, 1800-2015



Sources: See Appendix 2. Notes: WR is the welfare ratio for urban unskilled wages, i.e. 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. Line breaks show changes in wage series. Lines are moving averages.

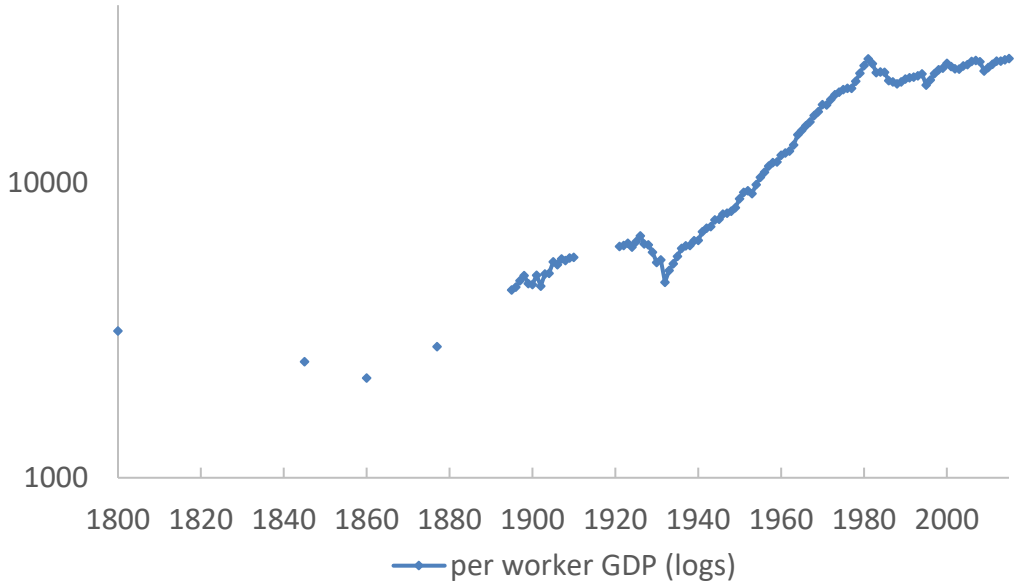
[22] As pointed out by Milanovic (2006), a lower bound on typical wages due to subsistence needs implies that the maximum feasible inequality is constrained by per capita incomes.

Figure 2: Inequality in the long run, GDP per worker over wages, 1800-2015



Sources: see Appendix 2. Note: *y* is nominal GDP per worker. *w* is nominal unskilled urban wages. *w_median* is nominal national median wages. The line is a moving average of the *y/w* estimates.

Figure 3: Real GDP per worker, 1800-2015



Source: EHM table 7.1 up to 1970, in constant 1970 prices, extended using growth rates from WDI. Note: Data are more controversial before 1900: see Appendix 2.

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.[23] Our estimated consumption basket is scaled to contain the same number of calories as these modern baskets. Over 1992-2015 the cost of the urban extreme poverty basket averages 1.33 times that of our basket, owing to 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 2005-2015 the welfare ratios of median income using the official poverty basket averages 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 (based on the survey ENIGH), according to which just over half of the population was below the income poverty line over 1992-2014.[24]

[23] Poverty data downloaded February 2017 from http://www.coneval.org.mx/Medicion/Paginas/Evolucion_dimensiones_pobreza_1990_2015.aspx,.
[24] The poverty rate averaged 52.7% over 1992 to 2014, with no consistent trend. Using 'patrimonio' poverty line 1992-2006 and 'bienestar' poverty line, that described above, 2008-2014. Both lines are estimated for 2008-2012 and are very close, suggesting they are reasonably comparable.

6. 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 paper, 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.[25] The most extended periods of conflict (insurrection in the 1810s and the civil war in from 1855 to 1867), sometimes compounded by agricultural crisis (1806-1819, and the mid-1860s), were periods of sharp decline. In terms of inequality, *y/w* declined about 25% from 1800 to 1860 due to falling GDP. Our data confirm some features of the revisionist economic history of this time period that highlights the recovery of the economy after insurrection (Chowning, 1999), the destructive nature of armed conflicts in this era (Sánchez Santiró, 2010) and improvements in inequality (Tutino, 1986, and Williamson, 2010).

Second, the dramatic growth over 1876 to 1910, fuelled by international lending, foreign direct investment and exports, led to no improvement in typical living standards (Figure 3).[26] The doubling of per worker GDP combined with stagnating wages translated into a similarly dramatic rise in inequality.[27] In this sense Mexico fits the pattern of rising inequality in the USA and Australia in this period discovered by Williamson (1997, p. 126). Williamson argues that in the labour-scarce Anglo offshoot countries this was due to immigration pushing down relative wages. Mexico, in contrast, was not labour scarce, and not a major recipient of immigrants in this period (Buchenau 2001), suggesting that forces other than the Heckscher-Ohlin model were at work. More likely is the point emphasized by Coatsworth (2008) and Williamson (2010) that the growth in returns in the capitalist export sector were concentrated in few hands, and outpaced wages.

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 1900-1910. 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 (Haber, Razo and Maurer, 2003; Womack 1986).

Fourth, there is 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

[25] The rising degree of inequality under these circumstances was the subject of studies by Challú (2010) and Van Young (1992).
[26] See O'Rourke and Williamson (2002) for a discussion of the globalization of the late nineteenth century. Gómez-Galvarriato (2013), Haber (1989) and López-Alonso (2012) also find evidence of increasing inequality in the Porfirian period.
[27] Arroyo Abad and Astorga (2017) 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.

from 1934. This is consistent with several independent studies cited by Bortz and Aguila (2006: p. 121), including a report of the General Motors Company for Mexico from 1942 that complained that real wages and benefits rose 44 percent in dollar terms between 1935 and 1940. This jump may have 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 (López-Alonso, 2012), while the period of our highest welfare ratio coincides with the fastest growth rates of heights (López-Alonso and Vélez-Grajales, 2017). From the Second World War to the 1970s was a period of 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% in 1940 to 23.0% in 1970,[28] while per worker GDP grew at an average rate of 2.8% through the 1970s. Real wages reached their highest level ever during this period while inequality declined through 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 5 hectares) outpaced growth in GDP from 1930 to 1960, also supporting a decline in inequality.[29] Moreover, a set of rural subsidies raised purchase prices of corn and other staples, lifting rural incomes.[30]

Our finding that growth was broadly inclusive during the 'Mexican miracle' mirrors Bértola's (2005) findings for Uruguay and Rodríguez's (2017) for Chile over the same period. But it is a key point of disagreement with much of the historiography for Mexico, which claims that inequality rose (e.g. Middlebrook 1995, Bortz 1987, Prados de la Escosura 2007). However, as we show in Appendix 1, 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

[28] Estadísticas Históricas de Mexico, Table 5.6.
[29] Authors' estimates based on data from Solís (1970, chapter 4).
[30] Doroodian and Boyd (1999).

in contrast to Arroyo Abad and Astorga (2017), who find a global 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.[31]

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 (Ochoa 2000, pp. 1-3). 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 (Hamilton, 2011, chapters 3 and 5). 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 that they have never recovered from. Mexico experienced a currency crisis in 1976 and implemented an IMF-supported adjustment program over 1977-79.[32] 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,[33] 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.[34] 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 moves in tandem with the actual 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. 1999 is the year of the highest inequality over the period of more than two centuries. In the same year the

[31] The authors, and Astorga (2015, Table B-5), do not give exact sources for the 1950 wage data, referring to a mix of sources from the international organizations ILO, ECLAC and PREALC.
[32] Boughton (2001: 282-3).
[33] Bruhn (1996).
[34] CEPAL (1992: Cuadro IV-4, p. 98)

welfare ratio was 1.40, only 50 percent higher than its nineteenth century average of 0.91.

7. 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% of non-agricultural workers in Mexico were employed informally still in 2009 (ILO 2012).[35] 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 over 2005-2016, earning on average 40% more than the median.[36] 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 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 Lewis (1954) and Kuznets (1955) is that they assume no productivity growth in the traditional sector. This does not seem appropriate in most countries, which have seen at least some wage growth in traditional sectors (Gollin 2014). 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,

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

[35] By 2008 agriculture represented only 13% of the total workforce (Estadísticas Históricas de México, table 5.10). As Lewis (1954) noted, the traditional sector includes the range of casual urban workers from street traders to retainers, which form a large share of the informal workers in Mexican cities, in addition to many rural workers.

[36] 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.

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.[37] This allows us to model the inverse Williamson ratio, which compares the unskilled wage to the returns on all factors of production (Williamson 1997: 126), in contrast to the labour share, which aggregates unskilled and skilled labour in order to compare it with capital. We assume a CRS neoclassical production function with Hicks-neutral technology A_M:

$$Y_M = A_M F(L_M, K). \quad (3)$$

Factor returns are equal to marginal product:

$$w = A_M F'_L \quad (4)$$
$$r = A_M F'_K \quad (5)$$

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 (1954), and discuss later – so the unskilled wage is equalized across the sectors:

$$w = A_M F'_L = A_T. \quad (6)$$

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

$$A_M F'_L|_{L^*_M} = A_T. \quad (7)$$

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:

[37] For simplicity we assume no pure rentiers, but this makes no substantive difference to our results.

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, the ratio y/w rises.

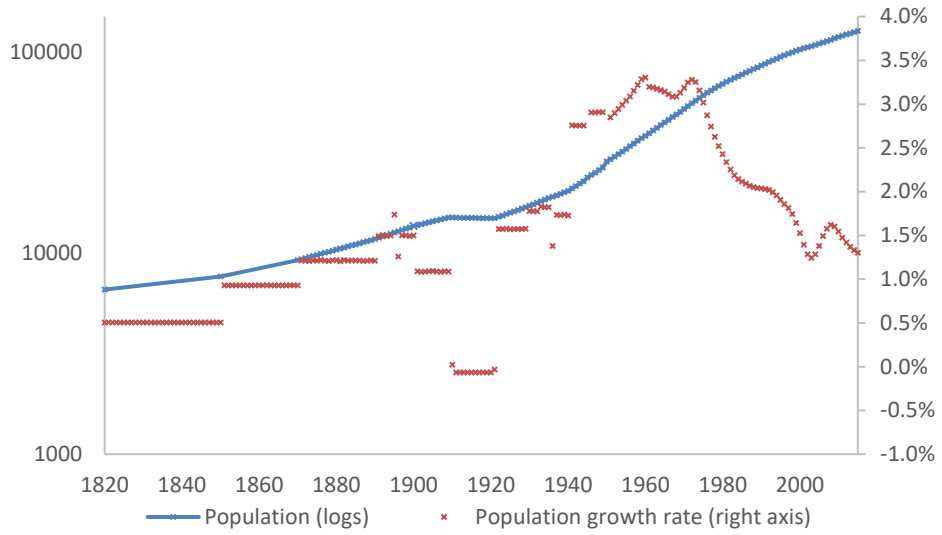
Thus technical progress in the modern sector, or a rise in the quantity of human or physical capital, will increase the inverse Williamson ratio as long as there is sufficient unskilled labour *L* to maintain production in the traditional sector.

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 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^* remained below *L*? The most straight-forward 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 global population growth of 3.4.[38] Mexico's population growth rate exceeded 2.5% throughout 1940 to the mid-1970s, peaking in 1960 at 3.3%; by 2000 it had fallen to 1.5%, still higher than Western Europe's mid-twentieth century rate of 1%. Gómez Galvarriato and Silva Castañeda (2007) 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.

[38] Angus Maddison, 'Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD', http://www.ggdc.net/maddison/oriindex.htm.

Figure 4: Population level and growth rate, 1820-2015



Source: 1820-1959: Angus Maddison, "Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD", http://www.ggdc.net/maddison/oriindex.htm. 1960-2015: World Bank, World Development Indicators.

Why no Kuznets process?

Kuznets's seminal model of the relationship between inequality and economic development also assumes a dual economy. But unlike in our model, he assumes that when the modern sector enjoys technical progress, unskilled workers within that sector also enjoy rising wages, diverging from those in the traditional sector.[39] 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, the Lewis assumption above of free mobility drives our finding that unskilled wages do not rise when the modern sector grows – an assumption which we refer to as the Lewis assumption.[40]

To analyse the implications of the two assumptions, we augment the model above 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

[39] Kuznets (1955: 12-16). Anand and Kanbur (1993) analyse what they call the 'Kuznets process' in more generality but also assume that within-sector distributions remain constant, implying that technical progress in the modern sector raises wages in that sector. Kuznets mentions the possibility of *declining* inequality within the urban sector (p. 17), the opposite of Lewis's assumption, but this is not in the model he presents.

[40] As far as we can tell, this key difference between the Lewis and Kuznets models has not previously been recognized. E.g. Bourguignon (2007) and Arroyo Abad and Astorga (2017) both refer to a 'Kuznets-Lewis' model, implicitly conflating the two models.

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.[41] 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.

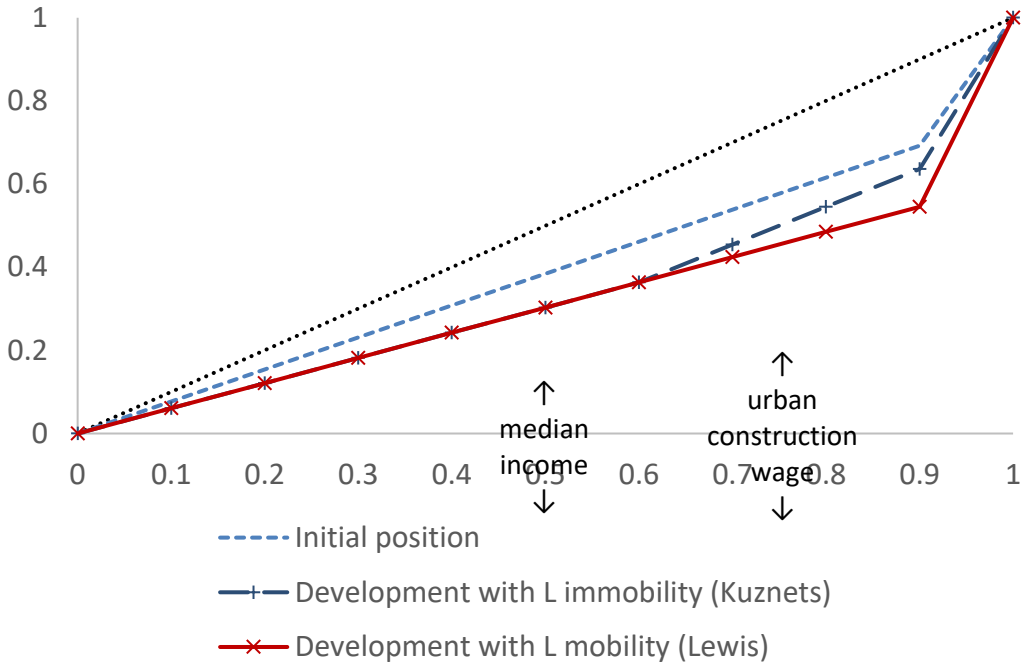
Now suppose there is economic development in the sense of technical change or capital deepening in the modern sector. Under the Lewis assumption, this will lead to a rise in unskilled employment in the modern sector L_M until its marginal product is equalized with that in the traditional sector, A_T. 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.[42] 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.[43]

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.

[41] As Gollins (2014, 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, e.g. if construction is a dangerous activity, or due to efficiency wages in the modern sector as in Temple (2005).
[42] 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 (1993), in part because of the existence of other factors of production that form the third segment the Lorenz curve.
[43] 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



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 Kuznets, wages of unskilled workers in the modern sector grow faster than aggregate productivity, and diverge from the median wage.

There is also direct evidence for this assumption. Germidis (1972) found that 28 percent of construction workers in Mexico City still owned land in the countryside,[44] and described construction work as a gateway from the subsistence to the capitalist sector. Similarly, Ball and Connolly (1987) highlights the connection between the construction industry and peasant and the informal sectors, from which it draws its labour force.[45] Ethnographies of the Mexican poor, such as Oscar Lewis (1951,

[44] 15% were *ejidatarios*, i.e. had rights to communal lands created by land reforms following the revolution, while 13% owned private small-holdings.
[45] Moreover, in Mexico City in 1945, for example, 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' (Bleynat 2017, p. 8).

1964) for the mid-twentieth century and Hellman (1999) for the late 1970s to early 1990s, provide qualitative evidence of fluid boundaries between the peasant and urban, informal and formal sectors. Maloney (1999), using household survey data for 1990 to 1992, gives quantitative support to the claim that workers move frequently between formal and informal employment and self-employment.[46]

8. Conclusion

Long run wage series allow 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 level of the nineteenth century. 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. Broad technical progress and infrastructure investment that benefitted the traditional sector led to the modest 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 inequality. The revolution of 1910-20 had an uncertain effect, but the changing political and social dynamics that followed led to the rising power of agrarian, labour and popular organizations in subsequent decades. This set the ground for a development model and political arrangements that supported economic growth and raised wages from the 1950s. Given similar recent findings for mid-twentieth century Chile and Uruguay (Bértola 2005, Rodríguez 2017), this may be an under-appreciated regional pattern. In Mexico the basis of that model was not

[46] Maloney presents this finding as contradicting the 'dualistic view', but as we explain it is consistent with, and even required by, Lewis's version of dualism.

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 which 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 USA, the last third of the twentieth century called into question the standard assumption that productivity growth automatically raises living standards (Dew-Becker and Gordon 2005, p. 68). 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.

Appendix 1: 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 over 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 Banxico. Sanchez Santiró (2010) provides estimates for a different set of years from Coatsworth over 1800-1877 but their average level is virtually identical. However, where the Coatsworth and Banxico overlap, in 1895 and 1910, Coatsworth's estimates average only 78% of the value of Banxico'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 (2016) estimate GDP per capita in Mexico up to 1800. Their 1800 estimate is just over PPP$800 (1990 PPPs; read off their Appendix figure 5, p. 1206), about 7% below Coatsworth's estimate of PPP$755 (1990 PPPs; Coatsworth 2008, p. 547). Thus using their estimate for 1800 would not materially change our findings.

Alternative inequality estimates 1950-1977

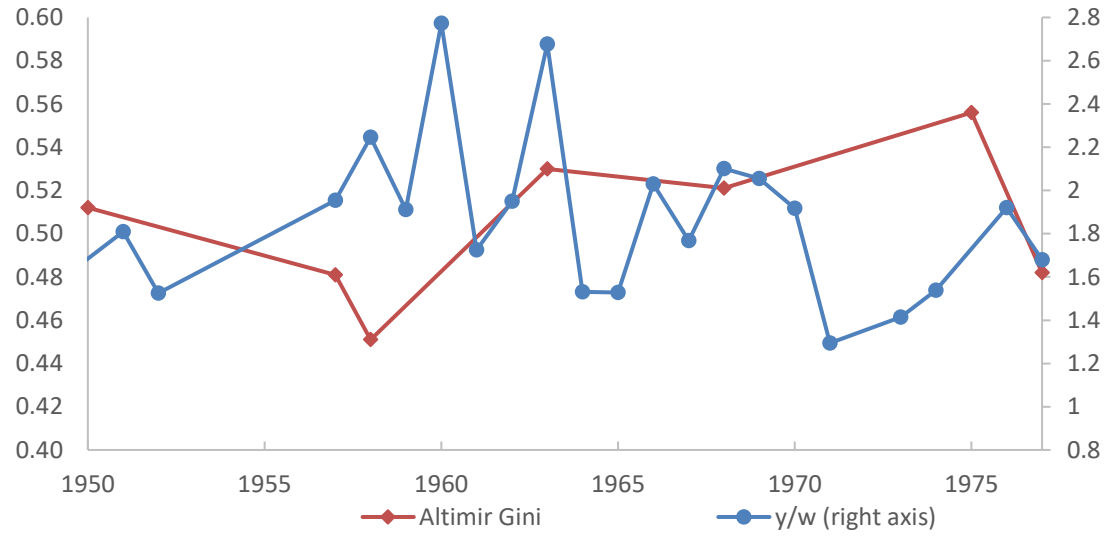
Estimates of inequality have been produced for several years in the period 1950-1977, before the establishment of the ongoing household survey ENIGH in 1984 and the occupation and employment surveys ENEU and ENOE from 1987, and were analysed by Bergsman (1980) and Altimir (1982).[47] Both point out serious problems of comparability between the different sources over time. Altimir points out that the different years' data were collected by different organizations following different protocols. They are not all defined using the same distribution. Such differences can lead to large spurious differences in measured inequality.[48] 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 (1980: table 2) reports that total incomes reported in the surveys for 1963 and 1968 are 80 to 82 percent of NA estimates while the surveys for 1975 and 1977 are 56 to 58 percent of NA estimates.

[47] Székely (2005) combines Altimir's estimates with ENIGH data to produce a series for the period 1950-2004, but acknowledges the comparability problems analysed by Bergsman and Altimir.
[48] For instance, Atkinson and Brandolini (2001) 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 off their figure 2, p. 779).

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 (1980), 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 (1987) and by Middlebrook (1995) to support their claim that inequality rose in this period.[49]

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' (p. 17). Overall, there is no clear trend in the Gini estimates and no evidence that inequality rose over 1950-1977. This is consistent with our finding that there is no trend in *y/w* over the period.

Figure A1: Inequality 1950-1977, Gini coefficient and y/w



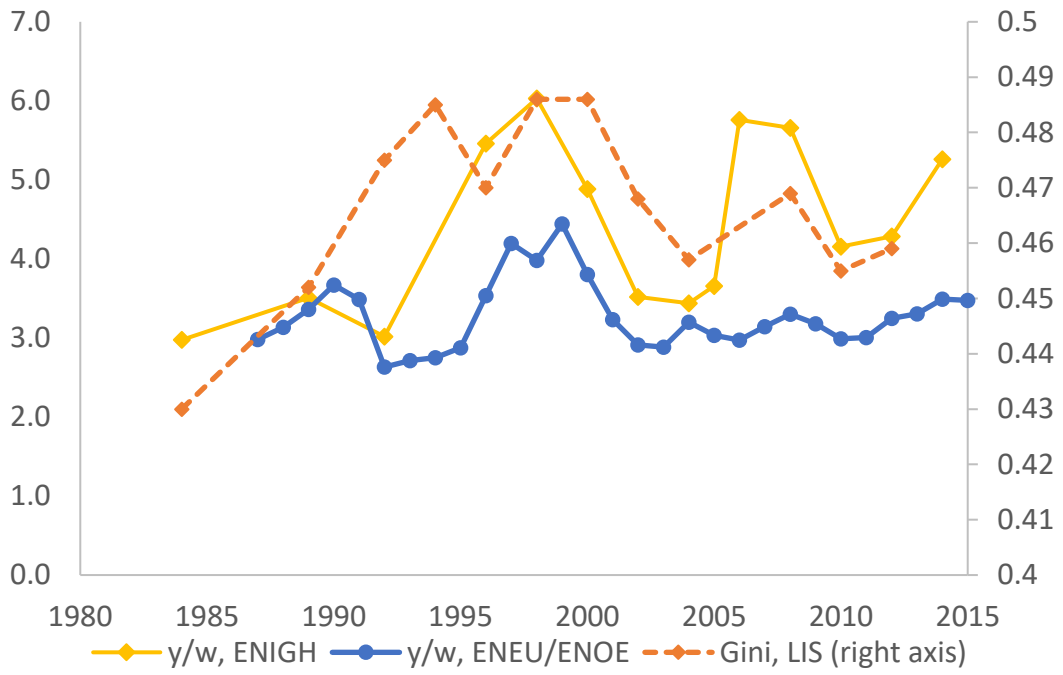
Source: Altimir (1982) for Gini coefficients; figure 2 for *y/w*.

[49] Middlebrook cites income shares for 1950 due to Navarrete (1970) and for 1968 due to Felix (1982), both reported in Felix (1982). Bergsman explains that Navarrete and Felix use inconsistent methods of adjustment, exacerbating the already-present underlying problems of comparability. Bortz relies on the same set of estimates (including Ginis reported by van Ginneken, 1982, who himself relies on Navarette) and also switches sources and hence methods over time, similarly reducing comparability.

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 a still-more extreme long-run rise in inequality than in our main estimates.

Figure A2: Inequality in Mexico, y/w and the Gini coefficient, 1984-2015



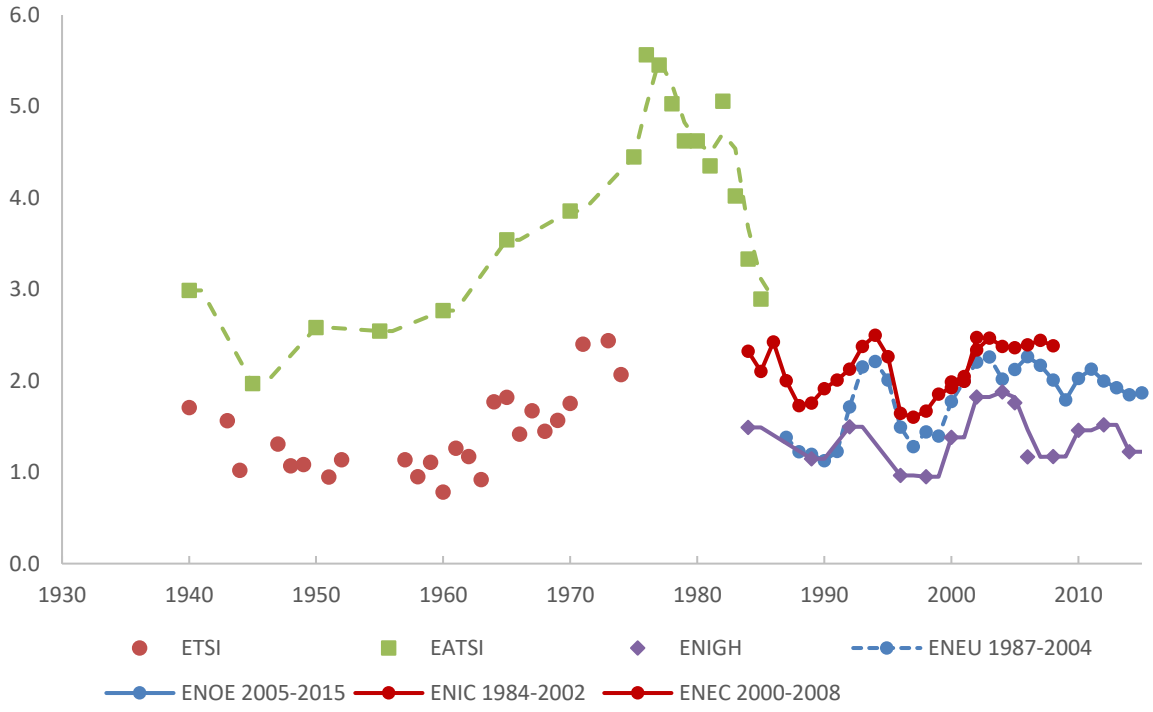
Source: Authors's calculations and LIS [www.lisdatacenter.org/lis-ikf-webapp/app/search-ikf-figures].

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 2000-2008, reported in EHM (tables 6.156 and 6.157). 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 1939-1985 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 series for all industrial workers in the Federal District, 1939-1985, alongside the ETSI data for just unskilled construction workers in the same zone, for comparison.

Figure A3: Welfare ratios 1939-2015, comparison of alternative data sources



Sources: See text. ENOE is the successor to ENEU and is plotted in the same colour. The same applies to ENEC and ENIC. Notes: Different series apply to different sets of workers, as described in the Appendix. Our primary series in figure 1 is ETSI, extended to1985 using EATSI growth rates, followed by ENEU and ENOE. Welfare ratios are defined relative to our consumption basket for 3.15 equivalent adults, defined in the text. For EATSI, and ENIGH the lines are moving averages.

There are other sources we can also use for comparison with the construction wage. Over the 1820s to 1850s, our series was near the bottom of the urban male pay scale, 15 percent below male textile mill workers and a third higher than those of cook women.[50] 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

[50] García Luna (1998, 29), Bazant (1964, 134-137), AHDF, Ayuntamiento, vols. 508 (no. 6), 2300 (no. 20), 2304 (no. 32), 2305 (no. 110), 2306 (no. 14), and 2307 (no. 71).

95 to 67 percent), probably as a result of improvements in the labour conditions of the textile industry after the first collective bargaining agreements (Gómez-Galvarriato, 2013).

Appendix 2: Data sources and methodology

Gross Domestic Product

Estadísticas Históricas de México (EHM) provide estimates of both real and nominal GDP. The Banco de Mexico (Banxico) initiated the first solid measurements in the 1930s and continued refining the estimates to the present day. The same team that set up the initial methodology created retrospective estimates from 1895 (Solís 1970). Coatsworth (1978; 1989; 2003) estimates GDP in the years 1800, 1845, 1860, and 1877, 1895 and 1910. These reconstructions have been criticized (Salvucci, 1997; Sanchez Santiró 2010), but the revised figures do not imply very different trends and where Sanchez Santiró overlaps with Coatsworth, in 1869, the estimates are identical. More importantly, despite the flaws in the data, Coatsworth (1989)'s estimates are based on a common methodology with documented sources. For this reason we use Coatsworth's estimates up to 1877, and Banxico's for 1895-1970. We use World Bank data from 1971 to 2015. Where Coatsworth's and Banxico's estimates overlap, in 1895 and 1910, Coatsworth's are lower, so in Appendix 1 we show what difference this might make to estimated inequality.

We divide GDP by the number of people aged 15-64, as a proxy for the number of workers, using age estimates from EHM. EHM also reports estimates of the size of the labour force for 1895 to 1990, but these are inconsistent over time and contradict other sources, such as INEGI's estimates. Maddison (1991), whose estimates of per worker GDP are used by Williamson (1997), discusses the difficulties of applying a modern definition of the economically active population to historical data. Prior to 1913, Maddison assumes "that the labour force moved in the same proportion as the population of working age" (p. 250).

Wages

In focusing primarily on construction wages, we follow a common practice in the historical study of real wages (Allen 2001). Construction work is a well typified occupation with a clear set of skills, and is typically (and in the case of Mexico) remunerated in cash, not in rations or services. Even today's definition of "albañil" (mason) work in the National Commission of Minimum Wages closely matches the description of construction work in historical times (with the exception of the use of concrete).

Pay gaps for different skill levels within the category of albañil remain fairly consistent over our whole period. In the 1800-1930 data oficiales (skilled and semiskilled) earn on average 61 percent more than peones (unskilled), where the latter comprise 80 to 90 percent of albañiles. In the industrial surveys of the mid 1980s (ETSIC, 1987, described below) that distinguished workers by skill, the pay gap is 46 percent. In the household employment surveys for 1987-2015 (ENEU and

ENOE, described below), a comparable spread of skill levels is indicated by the fact that the 90th percentile of albañiles have wages 50 percent higher than the 50th percentile.

Our primary series for Mexico City wages are the following:

1. CGG Series: Challú and Gómez-Galvarriato (2015)'s daily wages of unskilled construction workers, 1800-1930: Based on Challú and Gómez-Galvarriato (2015)'s study of real wages in eighteenth century Mexico. Their wages relied on the accounting of construction work in public and religious institutions of Mexico City. This long series largely confirmed general unskilled wage trends observed by Allen, Murphy and Schneider (2012), and Arroyo, Davies and van Zanden (2012) in the colonial period, and Gómez-Galvarriato (2013) in the Porfiriato. The data are annualized daily wages of labourers ("peones") in a construction site.[51] Following the literature, we assume 250 work days per year.

2. ETSI Series: Weekly wages of unskilled construction workers ("peones") in Mexico City, most years over 1940-80, obtained from the Encuesta de Trabajo y Salarios Industriales (Annual Survey of Industrial Labour and Wages).[52]

3. ENEU/ENOE Series: Quarterly household survey data giving monthly wages after tax. ENEU over 1987-2004 covered urban areas only while its successor ENOE over 2005-2015 covers the whole country. Our primary wage series uses median post-tax wages of construction workers ("albañiles") in Mexico City and Mexico State.[53]

We used growth rates in the following series to extend the ETSI estimates from 1980 to 1985:

4. EATSI Series: Weekly wages of industrial workers in the Federal District, 1940-1985. These were obtained from EHM Table 6.6, and cross-checked with the original publication. While this series goes beyond construction workers, it is highly correlated to averages and minimum wages in Mexico City's construction industry (see Appendix 1, figure A2).

[51] In the earlier working paper version of this study we used a weighted average of wages of labourers and the higher-paid masons ("oficiales" and "albañiles"), resulting in estimates that about 29 percent higher than the labourer series used here. Both series follow the same long-run trends.
[52] The ETSI series is based on the archival research of Enrique de la Rosa, who generously shared his data with us. An earlier working paper version of this study used Bortz's wages of the construction industry in Mexico City, which is based on the average payroll of the ETSI. By using peones, our series insure better comparability with the other series.
[53] ENOE (2009: 118) employment category 5260. In the earlier working paper version of this study we used the average wage rather than the median wage, which included higher-paid construction workers such as brick layers and the higher-skilled "albañil oficial" and "maestro albañil". The use of the median construction worker's wage ensures we can interpret them as low-skill wages.

National median income is defined as median primary income of individual income recipients, and estimated using a combination of social tables (up to 1929), national censuses and surveys. The use of social tables involves several assumptions and estimates that we describe here. For the *circa* 1800 table, we use Cook (1942)'s tabulations of the EAP based on the well-known Revillagigedo Census of 1790-1792, and complemented this information with the distribution of income of rural sharecroppers and rural peons in the Bajío region (Tutino 1986, 385), and obtained rural and urban wages from Arnold (1988), Challú and Gómez-Galvarriato (2015), Garner (1993), and Van Young (1992), as well as from original archival research in Archivo General Municipal de Puebla, Fondo Tesorería, and Archivo Histórico del Estado de San Luis Potosí, Fondo Ayuntamiento; Arnold (1988). In total, our information on wages covers four cities and reports of rural wages in the northern, western and central regions. The resulting distribution is roughly consistent with the oft-cited contemporary report of inequality by Abad y Queipo (Williamson 2010).

The social table of 1827 is a distribution of consumption that, to our knowledge, has not previously been used. It is a pamphlet advocating the establishment of a new national lottery (*Lotería Nacional*, 1827). It divides the population in nine non-indigenous classes organized by equal intervals of expenditure (e.g. 0.5 reales per day, 1.0, 1.5 and so on). Our estimate rests on three assumptions: 1) the indigenous population were at the bottom of the distribution; 2) the savings rate of the majority of the population was close to zero; 3) all classes share a similar ratio of workers to the entire population, which we based on Tutino's estimates for the rural Bajío in this era (1986, 385).

Antonio del Raso (1845) provides a detailed social table for the state of Querétaro. Querétaro is located in the central region and, according to estimations of regional GDP of 1900, had an income level somewhat below the mean with a sectorial composition in line with most other states (Appendini, 1972). The report discriminates income and population weights of seven occupational categories. While Williamson (2010) used this report without corrections, we assume that the size of the occupations is representative of the whole country, but we use national averages of income for the urban and rural manual labor; for the income of managers and white-collar urban workers, we estimate using the ratios among different occupations in Querétaro.[54]

The estimate for *circa* 1905 is based on the aggregate figures of the EAP from the 1910 Census, which we complemented with wage data from 1900 to 1910, and Tannenbaum (1952)'s local analysis of the census that allowed him to divide the rural population in haciendas and free villages (1952, 23). The income levels of the three lowest quartiles of the rural population use the national average reported in

[54] Urban income is based on the same archival sources mentioned in 1800; rural income is based on a broad canvassing of rural history studies, all cited in the bibliography.

Simpson (1952, 335) and distributed it in three equal-size groups using the more detailed distribution that Tannenbaum (1952, 48) reported for 1885-87. Income in urban areas is based on EHM's series, and distributed according to the distribution of wages in the construction industry using the sources underlying the construction wage series of Challú and Gómez-Galvarriato (2015).

The 1930 Census provides a wealth of information on the distribution of the population and its economic production and income for the previous year. We constructed the EAP classification with the population census; but the original source provided little detail about the rural population. For that, we use the classification of rural properties (both individual and communal) from the agricultural census, and adopt Simpson's (1952, 331-335) estimates of rural incomes of ejidatarios (communal landholders), workers and landholders in general. As in the previous estimate, we used the national average of rural wages from Simpson (1952, 335) and calculated three tiers of income following the distribution of rural wages in 1885-87 (Tannenbaum, 48). Urban blue-collar wages were obtained from the Industrial Census, by selecting the five largest industries in six states representatives of different regions (Distrito Federal, Jalisco, Nuevo León, Oaxaca, San Luis Potosí, Veracruz). White-collar wages were obtained in a similar fashion for administrative employees of the same sample from the industrial census.

For 1950 we relied on the special economic section, tables 37 and 38. The data for 1969 is from the 1970 National Population Census, 1970, Table 49. From 1977 and onward we relied on national surveys: 1977: Reyes Heroles (1981); 1984: ENIGH; 2005-2015: ENEU (same source used in our construction wages).

Prices

To calculate real wages we need a consumer price index. In this we followed Allen's methodology (2001, 2011 and 2012), pricing a basket of basic consumption goods. The basket is based on a constant composition of products that satisfy the minimum needs of food, fuel, clothing, and lighting of a household. In practical terms, this means using a Laspeyres (fixed-quantity) index. While Dobado (2015) criticizes the Laspeyres assumption and some simplicities in the price indexes, sensitivity analyses in the literature (Allen, 2001; Allen, Bassino, and Ma, 2011; Allen, Murphy and Schneider, 2015; Challú and Gómez-Galvarriato, 2015) indicate that alternative specifications do not change the long-term trends in real wages obtained with this method.

Our starting point is on Challú and Gómez-Galvarriato (2015)'s basket for Mexico City and its price data for the pre-1930 period. The basket has twelve products: corn, tortillas, bread, beef, pork, beans, lard, sugar, soap, candles, charcoal, and cloth.

The set of goods is limited, but ensures comparability over the long term.[55] We scaled the caloric value of the food component to Mexico's the present-day poverty basket (CONEVAL, 2014: p. 96). After 1930 we extended the coverage of food prices to 1979 using the food price index of Mexico City in EHM's Table 18.13 ("Índice de precios de la alimentación en la Ciudad de México"), then to 2011 using item-specific indices from the Banco de Mexico (Banxico), and from 2011 to 2015 using national CPI from INEGI. This produces our first-round estimate, which we then adjust as described below.

Non-food prices were more problematic to extend into the present day given the changes in technology and products. The exception is the price of soap. We extended the price series from 1930 to 1978 using the rate of change in the wholesale price of regular laundry soap (EHM, Table 18.2), and Banxico's retail price of hand soap up to 2011. Lighting is an example of these difficulties. For the pre-1930 period, the price of tallow and then paraffin were used to construct this series. We use a wholesale price series of paraffin that begins in 1960 (EHM, Table 16.2). The missing years (1930 to 1960) were interpolated. The price of fuel presents similar challenges. Charcoal and firewood were the most common fuels in the nineteenth and early twentieth centuries. By the 1940s petroleum and natural gas gained increasing acceptance (Vitz, 2015). While a series of the price of petroleum is available, its evolution is virtually flat and remarkably flatter than other products, even those with heavy subsidies. By contrast, the aggregate of wholesale costs of energy for the production sector (EHM, Table 18.15) has a good correlation with the cost of firewood; its annual rate of change was used to extend fuel prices into 1978. Both candles and charcoal are extended from 1980 using Banxico's index for 'electricity and fuels'.

The clothing component before 1930 used the price of the squared meter of *manta* (rough cloth). After 1930 we only had the price of prepared cloths (typically shirts of different kinds), without a clear way to determine the quality of the product. Moreover, the rate of growth was much higher than in other industrial products. For this reason, we opted to rely on wholesale manta prices, which are available since 1960 to 1978 (EHM, Table 18.2). From 1979 we use Banxico's series for 'clothing, footwear and accessories'.

The above describes our first-round estimate. However, it implies the use of indices over more than 80 years after 1930, which means that measurement errors could potentially lead to substantial divergence from actual price levels. For this reason we check the prices of food items in 2015 with absolute unit prices (e.g. M$13.7/kg for corn tortillas) given by CONEVAL in their construction of the Mexican extreme

[55] We removed pulque and lamb from the calculation, due to lack of information in the twentieth century.

poverty basket.[56] These data indicate that our first-round estimates are very close to the correct level: in 2015 the real cost of the food component of our basket (using CONEVAL unit prices) is 14.4 percent higher than implied by our first-round estimate. (The food component comprises on average 0.88 of the cost of the entire basket in our first-round estimates since 1931.) Our final price series attributes this additional increase to the entire basket linearly over the period 1931-2015, raising the price level by an additional factor of 1.144^(1/85) each year.

[56] "Valor de la canasta alimentaria y no alimentaria", downloaded from http://www.coneval.org.mx/Medicion/MP/Paginas/Lineas-de-bienestar-y-canasta-basica.aspx. We were able to download the February 2015 edition. Earlier editions were not available. For lard and maize, which are in our basket but not in the CONEVAL basket, we used the average prices relative to, respectively, pork meat and corn tortillas in three online supermarkets, checked February 2017.

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