Mexico: 20 years of North American Free Trade Agreement: Socio- Environmental Trends and Unequal Exchange

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1.1 INTRODUCTION

With a population of almost 130 million, rich cultural and biological diversity and abundant natural resources, Mexico has the 11th largest economy in the world by Gross Domestic Product (GDP) -adjusted for purchasing power parity (PPP). Mexico sits within the upper-middle income group with a per capita income of 21,363 Int \$ [1].

Despite healthy macro-economic indicators, income and regional disparities are major challenges to social stability and prosperity. Mexico is one of the most unequal countries of the OECD. The bottom ten percent on the income rung accounts for only 1.36% of the country's wealth, whereas the upper 10% accounts for almost 36% [1].

While Mexico ranks high in the Human development index (HDI), reporting a 0.829 HDI, northern states generally enjoy 10% higher HDI with respect to southern states. Considering multidimensional poverty, including basic needs, social rights and decent living standards, 42% of Mexico's total population is living below the national poverty line [1], [2].

About 52% of the Mexican GDP is generated by small and medium size enterprises, while the remaining 48% relies on large enterprises. Small and medium size enterprises make up 72% of the formal employment in Mexico [3]. Unemployment rates are the lowest of all OECD member countries at 3.2 %. However, underemployment is estimated at 25 % [4].

During the 1980s and 1990s, the country undertook deep structural reforms, including privatization, deregulation, and trade liberalization. These led to large capital inflows, a surge in credit to the private sector, and an appreciation of the Mexican peso. Recently, the energy transition is a key strategy to push Mexico towards competitiveness and sustainability [5].

1.2 A FREE TRADE NATION

Mexico is an export-oriented economy and the 12th largest exporter in the world. Foreign trade makes up 76% of Mexico's GDP, a higher share than any other large country [6]. More than 90% of Mexican trade is under 12 free trade agreements (FTAs) covering 46 countries, more than any other nation [1].

Mexico's No. 1 export is manufactured products, followed by strong exports of silver, fruits, vegetables, coffee, and cotton. Mexico manufactures and exports the same amount of goods as the rest of Latin America combined [7]. Mexico imports machinery for metalworking and agriculture. It also imports electrical equipment, automobile and aircraft parts, and steel mill products [7].

One of Mexico's strategies to increase competitiveness has been to lower restrictions on the imports of raw materials in order to incentivize the export-oriented manufacturing industries. In doing so, the country strengthened its productive capacities in complex and highly value-added sectors such as machinery, electronics, transport vehicles and chemicals [1]. The frontal competition with exports from China and dependency on oil prices meant that the country lost competitiveness with respect to other emerging economies during the 2014 oil crisis.

1.2.1 North America Free Trade Agreement (NAFTA)

The North American Free Trade Agreement (NAFTA) is the most influential trade agreement, signed by the governments of USA, Canada and Mexico in 1992. The NAFTA mainly eliminated trade tariffs among North American nations, but also established the protection of intellectual property rights, removed barriers to investment, introduced mechanisms for dispute resolution, and set higher standards for environmental and labor protection [8], [9].

The NAFTA came into effect 1 January of 1994 with the promises of economic growth and thus better employment opportunities to reduce Mexican emigration. The same day The Zapatista Army of National

Liberation (EZLN), a civil resistance movement against neo-liberalism, rose in arms in the south of Mexico. The EZLN protested the agreement, warning that it would feed social inequalities and threaten indigenous rights, autonomy, land access and use of natural resources [10]. Since the 1980s, the EZLN worked to recover lands, dignify labor and protect self-determination of indigenous farming communities in resistance to extractives practices [11]. Their main hypothesis was that the NAFTA would reinforce a master-servant relationship where Mexican human and natural resources are displaced, undermined or employed for the benefit of USA-CAN [10], [12].

The entering into effect of the NAFTA had a profound effect on macro-economic indicators. Exports from Mexico to the United States rose beyond expectations from US\$18.5 billion in 1990 to US\$327 billion in 2017, while the value of imports to Mexico from the United States increased from US\$20 billion to US\$195 billion [1]. In 2017, the United States received 79% of Mexico's exports.

Trade with the United States and Canada has tripled since NAFTA's signing in 1994 [1]. The Export share of Mexico's GDP went from 30 to 49% since 1995 [13]. For Mexico, this has meant a diversification away from oil and agriculture and a growth from the aero-spatial, machinery, electronics and automotive industries [7].

Some of the negative social effects are that the levels of extreme poverty rose quickly after the NAFTA from 16% to 28% during the first five years, heavy investments in richer states and bordering states has left poorer southern states in systematically reinforced disadvantages [1]. Similarly, a higher dependency on energy, petro-chemicals and food imports from the USA following NAFTA has jeopardized food and energy autonomy. For example, one third of corn consumed in Mexico -the staple ingredient of Mexican diet- is now imported from the USA [10].

The average salary for a Mexican worker increased 16.7% between 1995 and 2016, compared to a 33.3% increase in USA and 38.5% increase in Canada in the same period [7]. Due to this trend, USA has argued unfair

attractiveness to foreign investment of Mexico due to "labor dumping" i.e. low cost labor. However, labor dumping has also meant that the minimum wage with respect to living costs in Mexico is lower today than prior to 1994 [10]. Therefore the updated NAFTA agreement, negotiated between 2018-2019, introduces quotas for the automotive and other key industries, major regulation of digital trade, and stringent labor and environmental regulations [9].

1.3 EXPECTED SOCIO-ECOLOGICAL EFFECTS OF THE NAFTA

The reduction in trade barriers may have positive or negative socio-environmental effects for Mexico. The following hypotheses were proposed as outcomes for Mexico prior to the NAFTA [14]:

- Expanding the scale of economic activity and thus expanding the required resources and derived pollutants.
- Altering the composition of economic activity. For example from a domestic to an export-oriented economy or away from primary industries e.g. away from agriculture and towards manufacturing and services.
- Reduced environmental impact per economic output by cleaner techniques of production or stringent environmental protection.

When it comes to the social and ecologically unequal exchange between nations, we adopt three general indicators that can be examined to determine its occurrence and characterize its magnitude [15]:

- Asymmetric net flows in the inter-regional trade balances of physical and human resources (e.g., embodied materials, energy, land, and labor)
- High-income nations outsource or exert a disproportionately large fraction of their ecological impacts in low-income

nations. In other words, territorial resource extraction and pollution ultimately sustains consumption lifestyles in richer nations.

- The lower-income nation is imposed upon to “serve” by being a net exporter of employment, while the higher income nations benefit from it as “masters” i.e. net importers [12]. In other words, the labour of a producing nation “servant” is ultimately sustaining the lifestyle of the beneficiary foreign nation i.e. “master”.

The master-servant metaphor alludes to the millions of workers in an unequal society with little means to change or choose their working conditions—i.e. modern-day servants to their masters. Complex global supply chains that make it difficult to trace who is acquiring what from whom traditionally obscure such relationships. MRIOs such as EORA shed some clarity upon the issue to some extent [12].

1.4 ANALYSIS

1.4.1 *Growth on Emissions and Resource Use since 1990*

All the consumption-based footprints grew between the period of 1990-2015. The carbon footprint increased by 50%, land by 32%, material by 46% and water by 566% (Table 1). Territorial based employment rose by 7% and consumption based employment by 14% (Table 2).

Mining and fuels, manufactured products and transport and communications grew substantially and make up 70% of the carbon footprint (CF) in 2015, while construction, services and agriculture equally share the remaining 30%. Although the service sector only makes up 10% of CF and public administration & trade make up 2%, those sectors have grown the most -by 65% and 78%, respectively. These results are in line

with previous analysis which show the high carbon intensity of the transport, housing and construction in Mexico, as well as the growing carbon and energy embodied in service sectors [16].

Between 60-70% of land, material and water are embodied in agriculture, fishing, food and manufactured products. Services is the third largest sector -embodying between 10-16% of these resources.

Table 1. Consumption based footprints of Mexico expressed in totals, share of footprint by sector in 2015 and growth rate (G.R.) by sector with respect to 1990.

	Carbon (kt CO2 eq)		Land (ha)		Material (M kt)		Water (M m3)	
	2015	G.R.	2015	G.R.	2015	G.R.	2015	G.R.
Total	524805	50%	81612	32%	1026	46%	63645	566%
Agri, fishing & food	9%	39%	56%	26%	36%	37%	51%	323%
Mining, Fuel & water	19%	50%	1%	48%	2%	9%	5%	394%
Manuf. Products	18%	35%	20%	36%	31%	29%	11%	1060%
Transport & communication	32%	57%	6%	43%	7%	93%	7%	2718%
Construction	10%	55%	5%	65%	15%	87%	8%	3411%
Services	10%	65%	10%	39%	9%	89%	16%	2983%
Public admin & trade	2%	78%	2%	57%	1%	114%	3%	4133%

1.4.2 NAFTA effect on Employment

The country's employment profile has changed moderately after 1995. In 2015, secondary and tertiary sectors together represent 85% of the formal labor force within the territory -a 10% larger share than in 1995.

In terms of territorial-based employment, the highest growth has been in mining and fuels (288%), manufactured products (122%), public administration and trade (110%) and construction (80%). The only sector

where territorial employment has declined is the "Agriculture, fishing & food" by 76%, potentially reflecting several phenomena: 1) the increasing automation of the agro-industries 2) evolution towards a manufacturing & service economy 3) displaced labor due to competitive foreign imports, specially of corn in this case [17]. Indeed, about 5 million farmers lost their livelihood and thus migration quickly spiked after the agreement [8].

Table 2. Employment in consumption and territorial (production) based accounting.

	Jobs (1000 ppl)					
	Consumption Based			Territorial Based		
	1990	2015	G.R.	1990	2015	G.R.
Total	30808	34987	14%	33263	35669	7%
Agri, fishing & food	26%	10%	-58%	28%	6%	-76%
Mining, Fuel & water	1%	1%	139%	1%	3%	288%
Manufactured Products	8%	10%	48%	7%	13%	122%
Transport & communication	8%	11%	59%	9%	13%	67%
Construction	10%	13%	58%	6%	9%	80%
Services	39%	39%	12%	50%	43%	-1%
Public admin & other	9%	16%	105%	8%	15%	110%

1.4.3 Pre and Post NAFTA trends in economic, social and environmental indicators

Figure 1 plots the relative change in GDP against the change in footprints with respect to 1990 levels. Here we discuss the pre and post NAFTA trends to better understand the effect of the NAFTA in pushing Mexico towards or away from sustainability i.e. lower impact and higher wellbeing [18].

In the four-year period prior to the NAFTA from 1990 until -and inclusive of- 1994, GDP (PPP) grew by 18%, corresponding to a 20% rise in CO₂ eq, 21% in material extraction, 68% in land and 58% in water. Whereas employment rose by 44% and the carbon intensity (CO₂/GDP) grew by 2%. This implies carbon and material growing nearly proportionally to GDP, while land, water and employment grew two to four times faster than GDP.

After the NAFTA -between 1994 and 2015- GDP (PPP) grew by 66%, corresponding to a 29% rise in CO₂, 15% rise in material, 12% growth in land and a staggering 368% growth in water footprint. This implies a deceleration of the carbon, material and land trend, which rose two to five times slower proportional to rises in GDP. On the other hand, the water footprint accelerated, rising by a steady factor of five with respect to GDP growth. Worth mention, the fast (export-driven) growth of GDP potentially explains the decline in carbon intensity of the economy by 22%(CO₂/GDP).

Surprisingly, employment declined by -1% during this period, despite being one of the main motivations for Mexico to join. However, the unemployment rate in Mexico is already one of the lowest of the OECD, meaning it is hard to expect further increases [1]. Other interesting factors that might impact such trends are emigration, demographic changes, informal economy, etc. An alternative -perhaps more valuable- indicator to shed light upon labor could be value added that remains within territory, salary increase with respect to living costs, or a multi-dimensional indicator of decent living [2], [18].

1.4.4 Land and Water footprints particularly sensitive to free trade

Consumption of land and water considerably sped up after NAFTA. Remarkably, the land footprint doubled between 1994 and 2003, whereas GDP only increased by 20%. After that peak, the changes in land footprints retracted and stabilized at a 32% yearly increase until 2015, which corresponded to a 65% increase in GDP.

The water footprint also grew quickly by 50% the first 5 years after NAFTA. After the year 2000, it rose even more starkly with GDP, reaching a 200% growth by 2013, corresponding to about 56% rise in GDP with respect to 1994 levels. Between 2013 and 2015 the water footprint made a final hike, up to 350%, corresponding to a modest 10% increase in GDP, thus indicating a high sensitivity of water footprint with respect to economic growth for Mexico at current income levels.

Figure 1. Relative change in socio-environmental consumption footprints plotted against changes in GDP with respect to 1990.

1.4.5 Evolution of Carbon Emissions: Production, consumption and intensity

Mexico has been a net carbon importer since 1990 and remained so up until 2015 (Figure 2). In 2015, the consumption-based carbon footprint amounted to 524 Mt CO₂ eq., out of which 94% were embodied in consumption and only 6% were direct emissions from households and governments who directly burn fuels for energy and transport.

From the 497 Mt CO₂ eq embodied in consumption, 74% were emitted domestically and 26% were imported; 10% from the USA, 6% from China, 1.5% from India, 0.7% from Canada and 8.5% from the rest of the world. From the 472 Mt CO₂ eq embodied in production, Mexico exported about 15% of its production emissions to the USA, 1% to CAN and 5.8% for the rest of the world.

The trend in absolute and per capita emissions experienced several dips, following energy-use trends [16]. The first one is noticeable in 1995, right after the NAFTA. Like many countries in Latin America, Mexico experienced a succession of domestic and external shocks. Namely, a severe domestic financial crisis of 1994/95. External factors that affected growth and consumption were the entry of China into the World Trade Organization in 2001, the bursting of the U.S. stock market bubble in 2001–02, the global crisis in 2008–09, and (to a lesser extend) the collapse in oil prices in 2014 [1].

Carbon intensity per unit of GDP has noticeably decreased after the NAFTA, nevertheless rising consumption heavily drives carbon emissions, eating-up efficiency gains.

Figure 2. Mexico production and consumption emissions in absolute (left axis), emissions intensity (blue left axis) and per capita (right axis).

1.4.6 *Has NAFTA contributed to the equal exchange of natural and human capital between USA-CAN and Mexico?*

This section examines inter-regional trade of emissions, resources and employment embodied in consumption between Mexico and USA-Canada. USA and Canada are taken as one single unit (US-CAN), given the negligible role of CAN in the magnitude of Mexican trade within North America.

Mexico went from being a net importer of emissions from USA-CAN in 1993, with a carbon trade deficit of -27%, to being a net exporter, with a trade surplus of 22% by 2013. A trade deficit or surplus is calculated as the

difference between exported and imported material, expressed as a percent of total trade.

Mexico has been a net exporter of materials to USA-CAN, with a trade surplus of 24% in 1993, which grew up to 49% by 2013, implying a doubling of material extracted for USA-CAN consumption.

Mexico has been a net importer of land and water during the period. The majority of land embodied in trade between partners is imported from USA-CAN for the sake of Mexican consumption, with a sustained trade deficit of 96% over the past 20 years. Previous analyses argue that land flows are contingent on imported resources, but this is not clear from high-level tier EORA analysis [19]. Moreover, recent studies show that all Canadian carbon imports to Mexico and half of USA are just intermediate inputs, to be reprocessed and shipped back to their original sources embodied in finished products [13]. The same might be true for land, except that USA and CAN are particularly abundant in land and forests, which might also partly explain the results [20].

While the magnitude of water flows between partners has clearly increased after the NAFTA, the virtual water trade gap has narrowed, coming from a trade deficit of -28% to only -9%. Nonetheless, Mexico has remained a net importer of water during the period.

Figure 3. Imported and exported emissions and resource footprints, trade balance and percent of deficit or surplus between Mexico and the USA and Canada taken as one (USA-CAN). Trade deficit or surplus is the trade balance expressed as percent of total trade.

Figure 4 shows the employment embodied in consumption and trade between Mexico and USA-CAN. The trend in labor exchange uncovers a master-servant relationship where USA-CAN are the net beneficiaries of Mexican labor with a 73% surplus. Noticeably, the labor imported from USA-CAN has remained at a similar level whereas the trade surplus has

been driven by the dramatic increase in exported Mexican labor. The increase in exported labor from Mexico might have indeed displaced USA-CAN manufacturing jobs, but those jobs are presumable destined to satisfy consumption in the region [9].

Figure 4. Imported and exported employment footprint, trade balance and percent of deficit or surplus between Mexico and the USA and Canada taken as one (USA-CAN).

1.5 DISCUSSION

In this section we discuss our results in the light of the hypotheses introduced above. When it comes to the hypotheses enunciated for Mexico prior to NAFTA [14]: (1) We confirm the expansion of the economy correlates with the expansion of emissions and resource consumption. (2) We confirm a change in the composition of economic activity, with the agro-based sectors losing employment share to manufacturing and services sectors. (3) We observe some evidence for eco-efficiency gains as indicated by reductions in CO_2/GDP , however this trend is mainly driven by export-related GDP growth than by eco-efficiency gains [16].

When it comes to the hypotheses around social and environmental unequal exchange [15], [19]. (1) We confirm that the unequal trade has increased after the NAFTA, with surpluses for carbon, materials and more heavily for labour -meaning Mexico has become a net source for these resources. Not so for land and water, where Mexico remains a net consumer (2) We confirm that a large portion of the increases in Mexico's carbon, material and water are destined to satisfy USA-CAN consumption. (3) We confirm a master-servant dynamic where the employment embodied in trade leaves Mexico with a 73% surplus -a net supplier of labor among NAFTA partners.

Despite declining carbon intensities, we cannot conclude that the NAFTA launched Mexico towards sustainability as we only find indication of relative decoupling of decelerating growth in emissions with respect to growth in GDP. A critique of carbon intensity as indicator for decoupling is the role of ballooning financial, services, and trade -all of them relatively immaterial sectors that inflate GDP and thus make the indicator unsuitable for confirming relative decoupling [21], [22]. Moreover, the increases in eco-efficiency are typically overwhelmed by the total volume increase in footprints i.e. rebound effect. similarly, trade-offs might occur where reduction in one resource (e.g. carbon) come at the expense of increase in another (e.g. water) [22], [23].

Indeed, after the NAFTA, Mexico has seen a slight deceleration in carbon and material, which remain nearly proportional to the growth in GDP, while land and water grow 2-5 times faster with respect to GDP growth - higher than for high-income nations [20]. Not so for territorial employment, which slightly declined within the period [8].

Our findings agree that new sources of carbon in Mexico are due to re-processing for exports within which were ICT equipment, iron and steel, electrical machinery, motor vehicles and parts, and rubber and plastic products [13].

1.5.1.1 *Limitations*

The suitability of EE-MRIO to determine unequal land flows has been questioned arguing the limitations to discern the extent to which land exports are contingent on energy, fossil fuels or even land imports from low-income regions [19]. While it is plausible that land exports from USA-CAN to Mexico are contingent on prior energy or other resource, this lies beyond this study and arguably beyond the power of high-level EE-MRIO analysis [13], [19].

Naturally, there is some variations across EE-MRIOs at country and product level [13]. A recent study based on Exiobase reports 81 Mt of CO₂ -and not 74 Mt- flowing MEX to USA, and 6 Mt -not 4Mt- from MEX to CAN [13]. This might also be driven by the gases included in the carbon footprint, where methane from livestock can partly explain the deviation [23].

We did not directly engage with some of the hypothesis of unequal exchange theory. First, we did not directly test whether “High-income nations outsource or exert a disproportionately large fraction of their ecological impacts in low-income nations [15].” However, this is a well-known fact, specially for food, energy carriers and raw materials [23].

Another untested hypothesis of unequal exchange is: "Exports from the lower income nations are more ecologically intensive, that is, they contain more embodied environmental impact per dollar sold, than exports from high-income nations [15]." Similarly, there is enough evidence of the generally higher carbon intensities to satisfy needs in lower income nations [18]. In other words, low-income countries tend to sell their natural resources -or right to be polluted- more cheaply [18]. Indeed, carbon intensity per economic output is about 2-3 larger in Mexico than the European average [16] -although USA is particularly carbon intensive among high-income nations [20].

1.6 CONCLUSION

The main socio-environmental trends in Mexico after the NAFTA have been increased carbon emissions and resource extraction -rather than net job creation. Therefore, we cannot conclude that NAFTA has pushed Mexico on track towards environmental nor social sustainability. We find reduction in emissions per unit of GDP but efficiency gains are nullified by net rise in emissions. Similar, we find no indication of decoupling growth in resource use and emissions relatively to GDP growth -neither in absolute terms with respect to 1990 levels.

We found clear evidence of negative environmental consequences for Mexico associated to the NAFTA. Most footprints grew more than proportionally with respect to increases in GDP during the first 5 years after the NAFTA. Nevertheless, the carbon footprint had risen 20% from 1990-1994, four years before the NAFTA, and only by 30% in the 10 years following the NAFTA -between 1994 and 2015. This indicates that while the NAFTA may have enhanced the carbon rising trends, Mexico was already on such track. Not so for land and water, which have risen starkly after the 1995 and appear highly sensitive (5x) to GDP growth.

We found moderate evidence for negative social consequences. The employment grew starkly prior to the NAFTA and then stagnated, even slightly declined, in the post-NAFTA period. However, the Mexican labor

embodied in USA-CAN consumption significantly increased. Meaning that there were no more formal jobs created but rather a shift in labor force employed to serve USA-CAN consumption.

As the government promised, economy grew after NAFTA -driven by rising exports, but domestic employment did not and emigration still increased [8]. Our results better support the forecast by the Zapatistas: The period following the NAFTA fed the unequal exchange of natural and human capital among trading partners, accentuating Mexico's role as a "factory" for North America and thus net source of carbon, materials and human capital for its northern neighbors. Although a net importer of virtual water, water exported to USA-CAN has risen dramatically after the NAFTA -which is especially worrying given the severe water scarcity issues in the country.

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