

# Structural Transformations and State Institutions in Latin America, 1900-2010

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## Abstract

There is a long-standing agreement on that economic growth and political development are mutually related to each other. Most explanations focus on institutional constraints, mainly property rights. While this paper recognizes this theoretical channel, it proposes an alternative one for the Latin American cases. Historically, agriculturalists had been a hegemonic group protected by institutions that originated in colonial times. These norms had survived due to institutional inertia, perpetuating their advantaged position. Building on the fiscal sociology and dual sector models I argue that a structural transformation marked by a secular decline of agriculture and substantial expansion of manufacturing helped political development by promoting the emergence of an industrial political elite. Industrialization altered the status quo not by rising incomes (*à la* modernization theory) but by rising a political challenger. Importantly, the structural transformation required both sectors to grow in a balanced fashion, leveling both elites in their relative political capacities. Economic equality led to subsequent inter-sectoral political agreements. I use the Chilean and Argentinean cases to illustrate the theory. In an effort to suggest that this hypothesis could be generalized to other countries in Latin America, I provide a number of time series analyses (VAR models, impulse response functions and Granger-causality tests) for a dataset spanning approximately 100 years on agricultural and industrial sectoral growths to support my theory.

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## I. SECTORAL CONFLICTS AND DEVELOPMENT

*Practically all governments are engaged in promoting one [group]. There are [...] landlord governments against the peasants and the industrialists*

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Lewis [1965, 410]

The literature on the relationship between political and economic development is vast. Without trying to survey all of it, there seems to be an agreement in that strong institutions cause better economic performance.<sup>1</sup> For example North [1990, 3] asserts that the idea that “institutions affect the performance of economies is hardly controversial.”<sup>2</sup> Most of the explanations focus on institutional constraints and property rights.<sup>3</sup> When property rights are secured via the state<sup>4</sup> or social norms,<sup>5</sup> there will be incentives to invest in infrastructure, research and development.<sup>6</sup> This is usually the case when political and military elites are constrained by institutions such as constitutions and parliaments.

This paper contributes to this literature by adding an alternative channel. Particularly, it complements our understanding of political and economic development from the sectoral conflict framework, specifically by (re)introducing and empirically testing the *dual sector economy model*. The political development literature has traditionally focused on socio-economic cleavages and potential alliances between a *homogeneous* ruling elite and politically excluded segments of the society, traditionally peasants or other disenfranchised groups such as the bourgeoisie. Moore [1966], Tilly [1992], Boix [2003], Stasavage [2008] and Acemoglu and Robinson [2009] are among the most prominent examples supporting this view. In this paper I focus on political divisions among the elite. This sectoral approach is hardly new. Just to mention some examples, O'Donnell and Schmitter [1986] emphasized the positive impact of elite outsiders on democratic transitions, Ansell and Samuels [2014] and Boix [2015] argue about the role of economic inequality/equality among the elite on political development, Waldner [1999] studies how the formation of a modern state should coincide with the incorporation of lower classes to produce developmental states, while Saylor [2014, 8] looks at the “coalitional basis of state building” and Mares and Queralt [2015] examine how income taxation in Europe is associated with inter-elite conflicts, particularly between the

Cite A&R's book chapter where they briefly consider two elites.

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<sup>1</sup>For the geography v. institutions debate, see Sachs [2003] for an example.

<sup>2</sup>Following others, this paper considers that institutional development is endogenous process (see Przeworski [2004, 185]). In a similar vein, Johnson and Koyama [2016] explains that in “the end, the motor of history is endogeneity [...] wealth, its distribution, and the institutions that allocate factors and distribute incomes are mutually interdependent and evolve together.”

<sup>3</sup>Johnson and Koyama [2016].

<sup>4</sup>North and Weingast [1989].

<sup>5</sup>Greif et al. [1994].

<sup>6</sup>Leblang [1996], Weingast [1997], Iyer and Banerjee [2005]. However see Clark [2009] and Mokyr [2016].

landed elite and the industrial elite. While the relevance of different economic and social elites has already been recognized, this paper complements this literature by bringing in the *dual sector model*. This model is a theory of why industrialization occurs<sup>7</sup> which by emphasizing the importance of macro-structural transformations explains the mechanics of economic growth. I link and empirically test the association between macro-economic transformations, the emergence of a disenfranchised industrial class with both political and institutional development.

The crux of the argument is that an economic structural transformation characterized by “a secular decline of agriculture and substantial expansion of manufacturing”<sup>8</sup> imposed tight constraints on the way politics was run by the incumbent landowning class. An elite divided on an *economic* cleavage should be at the same time divided on their *political* preferences, particularly regarding their attitude towards state centralization.<sup>9</sup> Consequently, an elite split along economic interests will use state power to influence certain policies and hence, growth and state building. I argue that the emergence of an efficient and productive industrial sector altered not only the structure of the economy (causing *growth*) but also the inter-sectoral balance of *political* power, making unsustainable the political monopoly run by the landed elites enabled by institutionalized practices inherited from the colonial period. Different preferences over state institutions, in the presence of equally efficient economic sectors (and consequently equally leveraged political elites), gave way to a series of inter-elite compromises. In this paper I identify one such compromise, the income tax law, and explain how it helped countries to construct a path of economic and political development. Elsewhere I have argued that the implementation of the income tax law in the early 20th century in Latin America was the keystone of sectoral conflicts and compromises, triggering a series of other state-building institutions.<sup>10</sup> While the process of state-building had started earlier,<sup>11</sup> the implementation of the income tax was an important building block in this process. Building on the fiscal sociology paradigm,<sup>12</sup> it was argued that income taxation around the 1920s contributed to form the Latin American state.<sup>13</sup> The faster the industrial growth, the higher the pressures to impose a tax to capture increasing industrial incomes and to develop skilled bureaucracies to administer and collect the tax. The income tax did not contribute to the state in revenue, it did so by triggering other state institutions and inter-elite alliances that generated long term political development.<sup>14</sup> In this paper I expand on this idea by arguing that *political* institutions of state-building such as the income tax law set in motion a path of long-term *economic* development.

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<sup>7</sup>Gollin et al. [2002, p. 160].

<sup>8</sup>Johnston and Mellor [1961, 567].

<sup>9</sup>See for example Llavador and Oxoby [2005].

<sup>10</sup>Bahamonde [2017].

<sup>11</sup>See particularly Kurtz [2013] and Soifer [2016].

<sup>12</sup>Schumpeter [1991].

<sup>13</sup>Indirect taxes are easier to collect, consequently they are typically administered by weak states (Moore [2004, 14]). For example, customs administrations have always been concentrated in a few critical locations, especially ports, requiring a less elaborated fiscal structure (Bertola and Ocampo [2012, 132]).

<sup>14</sup>See Bahamonde [2017] and Saylor [2014].

As it will become evident, the argument differs deeply from modernization theory. What causes political development is not industrialization *per se*, but the development of a productive landed elite which supplied labor and cheap foodstuff to the modern sector, promoting *balanced* economic development between the *two* sectors. In turn, balanced growth politically empowered *both* economic elites. In fact, in cases where biased ISI policies were implemented later around the 1950s, too much industrialization was generated, affecting negatively the agricultural sector and overall growth. In these polities, *long*-term economic growth was not achieved or it could not reach its productivity frontier (Argentina). However, when both elites were about of the same economic size, biased sectoral policies were more difficult to implement, setting a path of long-run economic and political development (Chile). In sum, when the elite structure was faint and the agricultural sector could not fulfill its role of labor and foodstuff supplier, the emergence of the industrial sector was compromised or delayed. Landowners were never challenged and there were less pressures to centralize the state, making less likely further institutional investments. Critically, industrialization and economic development caused political development because it created a political challenger not because it rose incomes.

The argument considers that agriculturalists had been a hegemonic group protected by practices inherited from institutions originated in colonial times, and that the modern strong industrial elite challenged those privileges. However, others have argued that the independence wars around the 1800s contributed to the collapse of all colonial institutions, including the privileges the landowning sector had. For example Mahoney [2010, 191] explains that the “wars of independence were violent and destructive; they saw the collapse of the colonial fiscal system [...] and the elimination of the colonial political order.”<sup>15</sup> However, the collapse of a number of institutions does not necessarily mean the collapse of the legacies of *the* colonial political economy. Capoccia and Kelemen [2007, 349] argue that “[e]ven where various institutions are interconnected, the occurrence of a critical juncture for one institution need not constitute a critical juncture with respect to all of its counterpart.” Following their advice of finding “the decision-making process, [and] identify[ing] which decisions were most influential,” I find in this paper that in Chile and Argentina the landed elites did have privileges that the industrialists did not have *because* of the inertia of colonial institutions. In fact, elsewhere I find that the implementation of the income tax was product of a series of inter-elite compromises that aimed to equate the political privileges of the two sectors, putting countries in a path of political development.<sup>16</sup> In this paper I focus on the intertwined relationship between political *and* economic development. The following [section](#) introduces the *dual sector model*, where I explain the mechanics of the emergence of the industrial sector and why it is relevant for political development. Next I present the Chilean and Argentinean [cases](#) to illustrate the theory and to provide some historical context. Then, in an effort to suggest that this hypothesis could be generalized to other countries

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Argentina: Do I have support for this?

<sup>15</sup>See also Saylor [2014, 55], Uribe-Uran [2001] and López-Alves [2000, 27-28, 35-36].

<sup>16</sup>Bahamonde [2017].

in Latin America, in the econometric [section](#) I provide evidence of different vector autoregressive models (VAR), Granger-causality tests and impulse response functions (IRFs) for a subset of Latin American countries and explain why when there were economic structural transformations there were also sectoral political conflicts and subsequent investment in institutional capacities. Lastly, I provide some final [remarks](#).

## II. STRUCTURAL TRANSFORMATIONS AND THE DUAL SECTOR ECONOMY MODEL

*When by the improvement and cultivation of land [...] the labour of half the society becomes sufficient to provide food for the whole, the other half [...] can be employed [...] in satisfying the other wants and fancies of mankind*

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[Smith \[1904, I.11.59\]](#)

The *dual sector* or *balanced growth* model argues that the economic system is divided into two sectors loosely defined as ‘advanced or modern sector’ or ‘manufacturing sector,’ and as ‘backward or traditional sector,’ or ‘agriculture.’<sup>17</sup> The basic intuition of this paradigm is that in order for the industrial sector to develop, it needs *first* an efficient and strong agricultural sector. Contingent on efficient agricultural productivity, the emergence of the industrial sector goes from a low-production sector eventually surpassing the agricultural sector. If the agricultural sector lacks economic efficiency, the industrial sector will hardly develop, leaving the country in an economic trap. This model is relevant for political development since it explains the rising of the industrial economic sector which in turn, as I argue, nurtured the emergence of an industrial political elite. Here I explain the mechanics of this model to then test it against political development in the econometric [section](#).

It was [Lewis \[1965, 151\]](#) who popularized the idea that “[t]he secret of most development problems is to maintain a proper balance between sectors.” The dual nature of the economy has been widely accepted and forms part of “a long tradition in development economics.”<sup>18</sup> And while dichotomizing the entire economy in just two sectors might sound as too much of an oversimplification, I follow [Dixit \[1973, 325\]](#) in that the dual economy model provides a significantly better description of the economy

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<sup>17</sup>[Jorgenson \[1961, 311\]](#). Importantly, I follow [Kuznets \[1967, 87\]](#) in that “mining is combined with [...] industry because of the large scale of its productive unit, its close connection with manufacturing, and the distinctive trend in its share in product and resources.” Similarly, [Debowicz and Segal \[2014, 237\]](#) includes mining within the industrial sector.

<sup>18</sup>[Kelley et al. \[1972, 8\]](#).

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because “it reflects several vital social *and* economic distinctions.”<sup>19</sup> Johnston and Nielsen [1966, 280] also explain that “[t]he reality found in most underdeveloped countries approximates this dichotomy [...] sufficiently.” In fact, Lindert and Williamson [1985, 354] explain that the dual-sector model “has become the dominant paradigm used by Third World observers.” However, “balanced growth is almost axiomatic as a desirable objective, for both developed *and* under-developed countries.”<sup>20</sup> For example, Bergquist [1986, 8] explains that “Colombia’s two traditional political parties crystallized in the 1840’s and reflected in many respects the dual nature of the Colombian economy.” While this is a stylized model which proportionates a good-enough description of reality, Dixit [1973, 326] is right in that a “major drawback of dualistic theories [...] is the total neglect of the service sector.”<sup>21</sup> However, the literature is consistent in that the third sector necessarily develops *after* the industrial sector is developed. In other words, industrialization is just halfway down the path to development. Galenson [1963, 506-507, 513] argues that “countries in which manufacturing output grew most rapidly also experienced the largest increases in tertiary employment.” This is also true for the Latin American case. Baer and Herve [1966, 95-96] explain that the textile industry in Latin America went through a process of automation freeing labor to other sectors.

Economic development depends on the emergence of the industrial sector which in turn depends on the development of a productive agricultural sector.<sup>22</sup> As Kuznets [1961, 59] puts it, “economic growth is *impossible* unless there is a substantial rise in product per worker in the agricultural sector.”<sup>23</sup> Following Jorgenson [1961, 311], Ranis and Fei [1964, 59], Jorgenson [1967, 291], Skott and Larudee [1998, 279-280] and Vollrath [2009, 290], the industrial sector uses capital and labor and has increasing returns to scale, while the agriculture sector uses only land (which is fixed) and labor (only input). This implies that the industrial sector is *structurally* protected: even when the agricultural sector is efficient, *ceteris paribus*, it cannot grow faster than an efficient industrial sector. The fixity of land requires countries to industrialize in order to grow, and for that they need first an efficient agricultural sector. This insight is shared by many other development economists. Hayami and Yamada [1969, 105] for example argue that “[i]ndustrialization and modern economic growth are basically *conditioned* by the level of agricultural productivity.”<sup>24</sup> There are two main reasons for why agricultural development is a prerequisite of industrial development: efficient agricultures are more likely to supply the industrial sector with cheap foodstuff and cheap labor. In Johnston [1951, 498]’s words, “[e]xpanded agricultural productivity releases people from the land for employment in industry [and] provides food for the growing population which is a characteristic of the industrialization

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<sup>19</sup>Emphasis is mine.

<sup>20</sup>Streeten [1959, 169]. Emphasis is mine.

<sup>21</sup>He continues: “As a very rough approximation, one might suppose these to expand in proportion to industry proper, and be absorbed in it for purpose of analysis.”

<sup>22</sup>Johnston and Mellor [1961, 567] argue that this process “seems to be a necessary condition for cumulative and self-sustaining growth.”

<sup>23</sup>Emphasis is mine.

<sup>24</sup>Emphasis is mine.

process.” This structural transformation is the key of economic growth. If the expansion of the agricultural sector is compromised, it will necessarily compromise the expansion of the industrial sector as well.<sup>25</sup> The political correlate is that weak *economic* sectors engender uncontested weak *political* elites.

The first reason for why a productive agricultural sector is key to industrial development is that more efficient agricultural techniques make agricultural production less labor intensive, allowing landowners to free workers which the industrial sector can rely on. The need for an improvement in agricultural production as a necessary step prior to industrialization “has been termed the ‘prerequisite’ hypothesis.”<sup>26</sup> Technologies such as “crop rotation, pest control, seed breeding [and] fertilizer use [represent] the major potential source of agricultural labor productivity.”<sup>27</sup> Nicholls [1961, 339-340] shows that advanced industrial countries initially had relatively more developed and productive agricultural sectors. In fact, Gallo [1991, 57] finds that in Bolivia, a primarily agricultural economy, “[t]he tools employed in production were few and rudimentary, the use of fertilizers was minimal, and methods for conservation of the soil were practically unknown until the beginning of the 1950s [...] As a result, productivity was very low.” However, highly industrialized countries such as Japan, the U.K., the U.S.S.R. and Taiwan adopted *prior industrialization* very efficient agricultural technologies such as higher-yielding varieties, fertilizers and other activities that improved farm practices.<sup>28</sup>

Surplus of labor naturally leads to a reallocation of redundant workers into the industrial sector, which is the crux of economic development.<sup>29</sup> Nurkse [1953, 33] in fact argues that development *means* “to employ the ‘surplus labor’ on the construction of capital.”<sup>30</sup> The literature coincides in that the ‘natural role’ of the agricultural sector is to provide labor to the industrial sector.<sup>31</sup> For example, Dixit [1973, 326] argues that the “agricultural sector *must* fulfill [...] its dual role of supplier of labour to industry and of food for the industrial labour force.”<sup>32</sup> While Lewis [1954] in his canonical work argued that there existed an ‘unlimited’ supply of agricultural labor, a word of caution is in order. It was Robinson [1936] who introduced the concept of ‘disguised unemployment.’ Though

<sup>25</sup>In fact Landon-Lane and Robertson [2003, 2] find that an important source of growth in developing economies is “derived through the reallocation of resources [particularly] by drawing labour moving out of traditional sector employment into the modern sector.”

<sup>26</sup>Kelley et al. [1972, 133].

<sup>27</sup>Ranis and Fei [1964, 62].

<sup>28</sup>Johnston and Mellor [1961, 571] and Johnston [1951, 507-508]. Similarly Caselli [2005, 723] explains that poorer economies have inefficient agricultural sectors which at the same time are the mayor source of employment.

<sup>29</sup>Ranis and Fei [1964, 7] argue that “the development problem may be said to lie in the gradual shifting of the center of gravity of the economy from the agricultural to the industrial sector.” In turn, Leibenstein [1957b, 51] argues that “a lack of adequate non-agricultural employment opportunities lies at the very root of the economic development problem [...] For it is the lack of alternative employment opportunities that makes it impossible to shift any significant portion of the labor force to the non-agricultural sector.”

<sup>30</sup>Similarly, Matsuyama [1991, 621-622] points out that “[i]ndustrialization [*consists of*] a shift of resources from agriculture to manufacturing.”

<sup>31</sup>Ranis and Fei [1964, 114] argues that “labor reallocation [...] is the *inevitable* and *natural* consequence of the continuous expansion of agricultural labor productivity.” Emphases are mine.

<sup>32</sup>Emphasis is mine.

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it was first used in 'structural' terms by [Rosenstein-Rodan \[1943\]](#), the concept was popularized by [Lewis \[1954\]](#) who employed this term in 'development' terms to signify *redundant labor force*.<sup>33</sup> Consequently the meaning of the supposedly 'unlimitedness' of labor should *not* be taken literally. The concept rather means *unemployment*. In fact, [Nurske \[1961, 225\]](#) points out that the concept "is commonly used to denote all types of rural unemployment." In other words, there is 'unlimited' supply of labor where the supply of labor exceeds the demand, or as [Leibenstein \[1957a, 102-103\]](#) puts it, "where the existing labor supply could cultivate more land without loss of efficiency."<sup>34</sup>

The second reason for why a productive agricultural sector is key to industrial development is because efficient techniques in agricultural production are able to supply cheaper foodstuff.<sup>35</sup> Workers with access to cheap food fosters industrial development by lowering the cost of subsistence, which is paid by the industrialist in form of urban wages. "It is *self-evident* that without increasing food output, the capitalist sector must remain in a stationary state."<sup>36</sup> Food surplus is a direct consequence of efficiency, and it is just as important as labor reallocation. In sum, as [Kuznets \[1961, 60\]](#) explains it, if "output per worker in agriculture does not rise substantially, economic growth in the first case will be stopped by scarcity of agricultural products, and in the second case by scarcity of labour."

Finally, the long-run sectoral equilibrium consists of an industrial sector with necessarily faster growth rates relative to the agricultural sector's. As discussed earlier, the fixity of land causes the industrial sector to be structurally protected. As land cannot increase, even when the agricultural sector is efficient, it cannot grow faster than an efficient industrial sector. This structural transformation affects the labor structure as well. In fact, [Harris and Todaro \[1970, p. 134-135\]](#) explain that while "the creation of an additional job in the urban area reduces agricultural output through induced migration, additional employment can be generated in the agricultural sector without reducing manufacturing output."<sup>37</sup> This implies that agriculture-industry productivity differentials "may even increase with development."<sup>38</sup> Actually, [Serrano and Pinilla \[2016\]](#) find that in Latin America there has been a declining role of agricultural exports as industrialization levels have increased. That said, it is important to say that "once an agricultural surplus emerges [...] the agricultural sector declines relative to the overall economy but continues to expand absolutely."<sup>39</sup> In

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<sup>33</sup>See [Ranis and Fei \[1964, 203\]](#) and [Jorgenson \[1967, 289\]](#).

<sup>34</sup>In any case, [Sen \[1966\]](#) explains that a number of important predictions made by the dual sector model do not need this assumption to hold for the model to work. One important consequence of this 'unlimited' or abundant/unused labor is that the industrial sector attracts these workers *without* increasing wages. [Ranis and Fei \[1964, 99\]](#), [Skott and Larudee \[1998, 280\]](#) and [Fields \[2004, 730\]](#) argue that a pool of *redundant* agricultural workers (a 'reserve army') is what prevents a rise in industrial wages. Additionally, reallocating redundant workers implies that the industrial sector can actually *absorb* agricultural labor surplus. Hence, it is argued that there must exist a sectoral technological bias, that is, the industrial sector should seek to employ labor-*using* technologies and the agricultural sector to employ labor-*saving* technologies. See [Kelley et al. \[1972, 7\]](#) and [Ranis and Fei \[1964, 97\]](#) for two examples.

<sup>35</sup>See [Jorgenson \[1961, 312\]](#) and [Ranis and Fei \[1964, 157\]](#).

<sup>36</sup>[Ohkawa \[1961, 21\]](#). Emphasis is mine.

<sup>37</sup>See also [Johnston and Nielsen \[1966, 280\]](#).

<sup>38</sup>[Kelley et al. \[1972, 110\]](#).

<sup>39</sup>[Nerlove \[1994, 14\]](#).



other words, it is the “the proportional contribution of agriculture to the growth in countrywide product per worker”<sup>40</sup> what decays, implying that the in the long run the agricultural sector “must also grow,”<sup>41</sup> specially given the continuing dependence on a constant supply of food.<sup>42</sup> Next [section](#) presents two cases with special references to structural transformations and political development.

### III. BRIEF HISTORICAL REFERENCES: CHILE AND ARGENTINA

**Chile: A Story of Elite Competition and Compromises** Historically, Chilean agriculturalists had been a hegemonic group protected by norms and institutions that originated in colonial times. Those norms had survived due to institutional inertia, perpetuating their advantaged position. As [Collier and Collier \[2002, 106\]](#) argue, the “national government was dominated by [...] owners of large agricultural holdings,”<sup>43</sup> while [Zeitlin \[1984, 13\]](#) explains that “landowners controlled both the vote and the labor power of the agrarian tenants [and] peasants [...] and this was the *sine qua non* of their continuing political hegemony.” Similarly, [Baland and Robinson \[2008, 1748\]](#) explain that “[c]ongressional representation was heavily weighted in favor of rural districts.” In the presidency also, landowners were the single most represented group.<sup>44</sup>

While on the one hand institutions, policies and other practices were biased against industrial elites, on the other, rapid industrial growth incentivized industrial elites to form pressure groups to offset the bias against them. The little public infrastructure that existed benefited the agricultural sector only. [Zeitlin \[1984, 41\]](#) explains that “the Montt regime did invest in the construction of Chile’s railways but only in the Central Valley and south-central zones [b]ut there was no public investment [...] in railroads built in the Norte Chico mining provinces.” To revert this situation, industrialists started to “form trade associations to engage in lobbying and propaganda.”<sup>45</sup> Eventually, these interests groups turned into political parties. [Collier and Collier \[2002, 109\]](#) explain that the *Alianza Liberal* was “the political expression of the new groups that began to emerge in the late 19th century with the expansion of the commerce and industry and [...] mining [eventually emerging] as a political force.” These new groups, backed by their economic leverage, put pressures to open the political system in a way that allowed industrial elites to gain egalitarian political conditions and equal access to state power. While initially both elites confronted each other in two civil wars,<sup>46</sup> war

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<sup>40</sup>[Kuznets \[1961, 45\]](#).

<sup>41</sup>[Ranis and Fei \[1961, 534\]](#).

<sup>42</sup>[Nicholls \[1963, 2\]](#).

<sup>43</sup>See also [McBride \[1936, 15\]](#) who argues that “Chile’s people live on the soil. Her life is agricultural to the core. Her government has always been of farm owners. Her Congress is made up chiefly of rich landlords. Social life is dominated by families whose proudest possession is the ancestral estate.”

<sup>44</sup>[Bauer \[2008, 45\]](#).

<sup>45</sup>[Weaver \[1980, 107\]](#). [Kirsch \[1977, 43\]](#) explains that “The SFF’s journal for 1884 and the following years is filled with numerous examples of the association’s gestures before congress, the ministries, and various state agencies in behalf of industrial interests.” One of the most important ones was ‘insufficient tariff protection.’

<sup>46</sup>[Zeitlin \[1984, 23\]](#) argues that the civil wars challenged a “large landed property [elite against a] productive capital [elite].”

was not sustainable over time. Given their relative *similar* degrees of economic development, both elites could mobilize armies with *similar* capabilities.<sup>47</sup> War was then more likely to exhaust all existent resources without producing positive outcomes for either sector. Consequently, Chilean agricultural and industrial elites opted for a political compromise. The keystone of these inter-elite compromises was the implementation of the income tax in 1924, which marked the beginning of an institutionalization path. As others have observed, “[t]here was visible bargaining: [the non-agricultural sector] (reluctantly) accepted taxation, *while demanding state services and expecting to influence how tax revenues were spent*.”<sup>48</sup> The expansion of political rights *among the elite* and the rise of the industrial sector shared the same timing. As Collier [1977, 683] has pointed out, “the real story of Chilean industrialization belongs to the Parliamentary period,” which goes from 1891 to 1925.

Both sectors were efficient. While some have argued that the agriculture sector was a backwards sector,<sup>49</sup> Robles-Ortiz [2009, 511] has been the main referent to argue the contrary. He explains that agriculturalists adopted different mechanization processes, remarkably increasing its productivity. For example, “the value of output per worker grew from \$216 in 1885 to \$492 in 1930 (in real pesos of 1910/1914), while the physical output per worker increased from 1,030 to 2,579 kilograms.” As predicted by the dual economy model, this led to a reallocation of labor, “especially in the 1870s with the onset of the nitrate economy [when] thousands of men left the countryside.”<sup>50</sup> In fact, Segall [1962, 18] explains that the mining sector attracted so much labor that the countryside eventually run out of enough labor. He explains that by 1843, the landowning elite taking advantage of its advantaged political position would, through their political representatives, implement a law granting policeman the duty to force unemployed individuals without a known contract to work forcefully in the fields.<sup>51</sup> The scarcity of rural labor around 1873 forced to pay laborers “twice as much as peons earned in the winter.”<sup>52</sup>

**Argentina: A Story of Structural Imbalances** In Argentina, there were two elites as well. Traditionally, it has been argued that the economic cleavage was between an export-oriented sector and an import-oriented sector. Based on the observation of others, I consider the overlap between the export and agricultural sectors, and the overlap between the import sector and the industrial sector. As Díaz-Alejandro [1966, 25] argues in his classic series of papers, “while the correspondence

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<sup>47</sup>Boix [2015].

<sup>48</sup>Carmenza Gallo, in Brautigam et al. [2008, 165]. Emphases are mine. She refers specifically to nitrate producers, one of the first industrial productions.

<sup>49</sup>Keller [1931, 231] argues that there existed in Chile a “falta de conocimientos técnico-científicos” in the agricultural sector.

<sup>50</sup>Robles-Ortiz [2009, 499].

<sup>51</sup>“Los terratenientes, sin brazos baratos, comenzaron a presionar. Y lo harán durante todo el siglo. Dueños de gran parte del poder, con el pretexto de impedir la ‘vagancia,’ obtuvieron de sus representantes políticos, un decreto drástico emitido el 16 de agosto de 1843. Entregando al criterio policial el reclutamiento forzado de los individuos sin ocupación contratada, para su utilización en las actividades agrícolas,” in Segall [1962, 18].

<sup>52</sup>Robles-Ortiz [2009, p. 503].

between exports and rural products, and between imports and manufactured goods has not been perfect [...] such correspondence has been quite close.”

This case presents an interesting paradox. The Argentinean industrial sector was weaker compared to the Chilean industrial sector, however the former grew faster than the later. As some have argued, there “is little disagreement among economists that the period from 1875 to the eve of World War I [was] the Golden Age [...] of Argentinean economic history.”<sup>53</sup> However, as Bulmer-Thomas [2003, 136] puts it, Argentina “had a relatively backward industrial structure for a country of its income and wealth. *Indeed, industrial labor productivity was lower than in Chile [...] despite Argentina's superior income per head.*”<sup>54</sup> The paradox can be explained by Argentina's weak inter-elite structure, but particularly by the weakness of the industrial elite. The literature seems to agree on this point. Bulmer-Thomas [2003, 188] explains that among the factors that explain Argentina's failure was “a social infrastructure geared to agroexports [and] a powerful rural elite.” An excessively powerful traditional sector suffocated the full potential of the modern sector, denying industrialists “the same status [the] agroexports” had.<sup>55</sup> And while the landed elites did promote industrialization via protectionist tariffs, they did so by imposing “modest tariff protection”<sup>56</sup> which moreover were “not always consistent.”<sup>57</sup> As predicted by the dual economy model, the industrial sector was that weak (i.e. did not develop its full potential despite their relative rapid growth) because the agricultural sector was also inefficient and the landed elite weak. As others have argued, landowners had a hard time obtaining “certain types of inputs (fertilizers, tractors, etc.) which could conceivably have allowed it to react to the decline in the real prices [...] by increasing productivity.”<sup>58</sup> Agricultural research was very limited too.<sup>59</sup> Not surprisingly, “in 1952 Argentina even had to spend precious foreign exchange to import wheat,”<sup>60</sup> suggesting a complete mis-allocation of agricultural resources, and overall, supreme inefficiency regarding food production. Another clear example that illustrates the dualistic sectoral linkages between both sectors, is the case of the textile industry. While the entire sector did poorly, the one that performed the worst, representing a big portion of the total agricultural output, was the textile sector. As Bulmer-Thomas [2003, 142] explains, the “outstanding weakness of Argentine industrialization was in the textile and clothing sectors,” which heavily depended on raw materials supplied from an inefficient agricultural sector. In sum, these remarks suggest that *unbalanced economic growth causes inter-sectoral political disparities, compromising long-term economic growth and further investments in state institutions.* In an effort to suggest that this hypothesis could be generalized to other countries in Latin America, next [section](#) provides

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<sup>53</sup>Campos et al. [2016, 209].

<sup>54</sup>Emphases are mine.

<sup>55</sup>Bulmer-Thomas [2003, 143].

<sup>56</sup>Bulmer-Thomas [2003, 188].

<sup>57</sup>Bulmer-Thomas [2003, 143].

<sup>58</sup>Díaz-Alejandro [1967, 157]. He continues: “Lack of world demand could hardly be blamed for such shrinkage in the quantum of exports, nor can crop failures explain more than a small part of the drop.”

<sup>59</sup>Díaz-Alejandro [1970].

<sup>60</sup>Díaz-Alejandro [1967, 157].

evidence of different time-series models where I explain why when there were economic structural transformations there were also sectoral political conflicts and subsequent investment in institutional capacities.

#### IV. TIME SERIES ANALYSES: VECTOR AUTOREGRESSIVE MODELS AND GRANGER CAUSALITY TESTS

*what a sector does is not fully attributable  
or credited to it but is contingent upon  
what happens in the other sectors*

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Kuznets [1961, 41]

*Structural change is clearly an endogenous  
process, driven by a variety of economic  
forces [...] also in the statistical sense*

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Temple and Wößmann [2006, 212]

**Granger-causality Tests** The emergence of a new industrial sector rose a new politically disenfranchised elite who demanded political and economic reforms beneficial to them. In exchange for these demands, the industrial sector accepted to be income-taxed. To confirm this hypothesis, the theory should pass a number of tests. First, *before* the inter-sectoral compromises and the income tax law was implemented, political institutions and social norms inherited from the colonial period were designed to allocate economic inputs (and hence *growth*) in a way that benefited the landowning class only. Hence, I expect to see that the transference of economic inputs went *from* the industrial sector *to* the agriculture sector, a *backwards* equilibrium as stated by the dual sector model. Second, *after* the income tax was implemented, we should see a *reversion* of the flow of inputs, going *from* agriculture *to* industry. In other words, the income tax, as an institution that contributed to develop further state capacities and institutional development, should be associated with a secular decline of agriculture and substantial expansion of manufacturing causing long-term economic growth. In econometric terms, we should see that the income tax reverted the way in which one sector ‘Granger-caused’<sup>61</sup> the other. Lutkepohl [2006, 42] explains that if some variable  $X$  forecasts variable  $Y$  (and not the other way around),  $X$  is said to ‘Granger-cause’  $Y$ . According to Granger [1980, 349], this concept of ‘causation’ is based on the idea “that the future cannot cause the past.” For simplicity sake, I do not show the derivation of this methodology, but it suffices to

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<sup>61</sup>Since this is not an experimental design, ‘causation’ does not mean these kinds of analyses allow us to make proper causal inferences. As Beck [1992, 241] explains, cointegration is not causal.

say that “a standard Granger causality test ought to demonstrate that both lagged changes in  $X$  and lagged values of the error correction component cause current changes in  $Y$ .”<sup>62</sup>

To measure sectoral outputs, I utilize the MOxLAD data,<sup>63</sup> particularly the *agriculture value-added* and *manufacturing value-added* variables.<sup>64</sup> The dataset spans from as early as 1900 to as late as 2010.<sup>65</sup> Table A1 in the Appendix section shows the details. Following Mahoney [2010, 5] I include two advanced economy countries (Chile and Argentina), two intermediate countries (Mexico and Colombia) and two less advanced countries (Guatemala and Nicaragua). Figure 1 shows sectoral outputs for each country, both before and after the income tax law was implemented. Table A1 also details the year when the law was implemented, and the source.<sup>66</sup>

Table 1 suggests that the income tax caused a structural transformation in (almost) all ‘developed’ countries, namely Chile, Colombia and Mexico. In all these cases, the income tax reverted the inter-sectoral growth equilibrium. Before the income tax law, industrial development Granger-caused agricultural development (all p-values are significant at the .05 level). While after the income tax law, the agricultural sector Granger-caused industrial development. Substantively, these results suggest that the income tax is associated to the overthrowing of the political institutions that permitted the biased development of the landed elite who had inherited its privileges during the colonial period. And that the reversion of the original and backwards macroeconomic structure set in motion a path of long-term economic development. In Nicaragua and Guatemala the tests suggest the exact opposite (all p-values are significant at the .05 level).<sup>67</sup> While the story begins just the same, i.e. agriculture Granger-causes industry, the implementation of the income tax did *not* revert the initial backward macroeconomic equilibrium. These results suggest a supply-demand coordination failure where landowners have not been able to fulfill their role of cheap labor and foodstuff suppliers, while weak industrialists have not been able to absorb the few labor received from the countryside. Substantively, this underdevelopment *economic* trap has perpetuated suboptimal *political* institutions sustained by uncontested agricultural elites, contributing to the political backwardness of these two cases. The Argentinian case is different. The Granger tests are inconclusive, and non significant results were found in either period. This means that the sectoral economic linkage has failed to structure the economy in such way to produce long-run economic growth. Moreover, in this example there was a

<sup>62</sup>Durr [1992, 197]. For the formula, refer to Lütkepohl [2005, 41-51].

<sup>63</sup>“These data build on the studies and statistical abstracts of the Economic Commission for Latin America, but also rely on Mitchell’s International Historical Statistics, International Monetary Fund’s International Financial Statistics, the World Bank’s World Development Indicators and a variety of national sources.”

<sup>64</sup>The former measures “the output of the sector net of intermediate inputs and includes the cultivation of crops, livestock production, hunting, forestry and fishing.” The later “[r]eports the output of the sector net of intermediate inputs.” Both of them are expressed in local currency at 1970 constant prices.

<sup>65</sup>According to Astorga et al. [2005, 790], this dataset provides extended *comparable* sectoral value-added series in constant purchasing power parity prices.

<sup>66</sup>Some countries implemented some kind of income tax before, however the law lacked enforcement, it was weak or not at all followed. In Table A1 in the Appendix section I establish the year that the literature seems to agree for when the law was implemented and properly enforced.

<sup>67</sup>Except for the pre income tax period test of Guatemala, which is significant at the .1 level.



**Figure 1:** *Inter-Sectoral Conflicts and Structural Transformations: Sectoral Growths Before and After the Implementation of the Income Tax Law*

situation of structural imbalance which begun with ISI policies designed to *harm* the agricultural sector (or ‘export’ sector) permitting *too much* industrialization. As I explain *later*, ‘unbalanced’ growth was due to the incapacity of the agriculture to produce raw materials and food one the one hand, and the inefficiency of the industrial sector.

**Vector Autoregressive Models (VARs) and Impulse Response Analysis (IRFs)** Once we have determined that the directionality of economic development is associated with the imposition of the income tax law, it is necessary to establish the inter-sectoral long-run economic equilibrium. It does not suffice to say that the income tax reversed the initial backwards underdevelopment trap. In order to confirm my hypothesis it is necessary to find positive evidence for a *long-term* equilibrium between the two sectors characterized by a secular decline of agriculture and substantial expansion of manufacturing. This relationship is an endogenous one.<sup>68</sup> If this endogeneity is not accounted for, the error term and the regressors will be correlated, and so OLS will be inconsistent.

<sup>68</sup>Mahoney [2010, 8] argues that “variables that are robustly related to growth rates are small in number and closely tied to the phenomenon of development itself.”

Country	Pre/Post Income Tax	Sample	Directionality	chi2	P-value
Chile	Pre	1905 - 1924	Agriculture $\rightarrow$ Industry	3.55	0.47
			Industry $\rightarrow$ Agriculture	12.13	0.02
	Post	1928 - 2009	Agriculture $\rightarrow$ Industry	11.92	0.00
			Industry $\rightarrow$ Agriculture	5.37	0.07
Colombia	Pre	1902 - 1935	Agriculture $\rightarrow$ Industry	4.96	0.03
			Industry $\rightarrow$ Agriculture	10.44	0.00
	Post	1938 - 2009	Agriculture $\rightarrow$ Industry	4.32	0.04
			Industry $\rightarrow$ Agriculture	1.63	0.20
Argentina	Pre	1903 - 1933	Agriculture $\rightarrow$ Industry	4.19	0.12
			Industry $\rightarrow$ Agriculture	.42	0.81
	Post	1937 - 2010	Agriculture $\rightarrow$ Industry	.18	0.91
			Industry $\rightarrow$ Agriculture	1.37	0.50
Mexico	Pre	1902 - 1965	Agriculture $\rightarrow$ Industry	.73	0.39
			Industry $\rightarrow$ Agriculture	11.57	0.00
	Post	1969 - 2009	Agriculture $\rightarrow$ Industry	5.56	0.06
			Industry $\rightarrow$ Agriculture	1.32	0.52
Nicaragua	Pre	1923 - 1974	Agriculture $\rightarrow$ Industry	.48	0.79
			Industry $\rightarrow$ Agriculture	6.83	0.03
	Post	1977 - 2009	Agriculture $\rightarrow$ Industry	.014	0.91
			Industry $\rightarrow$ Agriculture	4.96	0.03
Guatemala	Pre	1924 - 1963	Agriculture $\rightarrow$ Industry	2.18	0.54
			Industry $\rightarrow$ Agriculture	6.72	0.08
	Post	1966 - 2009	Agriculture $\rightarrow$ Industry	.58	0.45
			Industry $\rightarrow$ Agriculture	6.05	0.01

Table 1: *Granger Causality Wald Tests*

Additionally, growth rates are usually integrated. ‘Unit root’ or ‘integrated’ vectors (denoted by ‘ $I(1)$ ’)<sup>69</sup> are time-series that “wander” up and down, yet they never revert to a given mean.<sup>70</sup> Moreover, two integrated vectors that are mutually endogenous imply a ‘cointegrated’ relationship, imposing additional statistical restrictions. Granger [1981] suggested (and further developed in Engle and Granger [1987]) the concept of cointegration which means “that if the components of  $x_t$  were all  $I(1)$ , then the equilibrium error would be  $I(0)$ .” In simple, a “set of integrated time-series is said to be cointegrated if some linear combination of the series in levels produces a stationary series” (denoted by ‘ $I(0)$ ’).<sup>71</sup> In practice, all these mean is that cointegrated series (denoted by  $CI(1)$ ) are mutually dependent on each other. The economic literature generally coincides in that economic



growth is an I(1) process, and that sectoral development is a CI(1) process. For example, [Hatton and Williamson \[1991\]](#) and [Blunch and Verner \[2006\]](#) study sectoral growth using cointegration methods.<sup>72</sup> Consequently, I expect both industrial and agricultural growth to be *individually* integrated but also expect them to be *jointly* cointegrated (as predicted by the dual sector model).

However, both integration and cointegration are assumptions that should be tested.<sup>73</sup> The first step is to find strong evidence for integration in each of the series. In [Table A2](#) in the Appendix section I show several unit root tests, including the Augmented Dickey-Fuller, the Phillips-Perron<sup>74</sup> and KPSS tests<sup>75</sup> for both *before* and *after* the implementation of the income tax law as well as for the whole sample.<sup>76</sup> [Table A2](#) indicates that all variables, periods, sectors and countries have I(1) processes. This is crucial as the analyses of cointegrated vectors require having integrated series of the same order.<sup>77</sup> The second step is to find evidence of cointegration.<sup>78</sup> Cointegration implies a long-run equilibrium between the two sectors. Substantively, positive evidence of cointegration means that there is a long-lasting mutual inter-sectoral economic *dependence*, i.e. labor and foodstuff being re-allocated from the countryside to the cities allowing *both* sectors to grow in a balanced fashion. The political correlate of balanced growth is that both elites have the same economic leverage to bargain and influence mutually beneficial policy outcomes. Failure to find evidence of cointegration implies coordination failures between the two sectors (economic backwardness), the delayed emergence of a political challenger, the lack of a sectoral conflict, and consequently a politically unchallenged landed elite. The assumption of cointegration is usually tested via two procedures, the `trace` and `max` statistics. Since this is a bivariate growth regression (which I explain later), should we find evidence of cointegration, the maximum number of cointegrated vectors is given by  $n - 1$ , being  $n$  the number of equations/variables. Since the maximum cannot be larger than

Be specific and write down what's the null hypothesis of each test here.

<sup>69</sup>The order of integration could be higher than 1. However, for simplicity sake, I restrict my analyses to I(1) processes, which is the most common strategy in applied econometric analyses of time series.

<sup>70</sup>[Box-Steffensmeier et al. \[2014, 129\]](#).

<sup>71</sup>[Durr \[1992, 193\]](#).

<sup>72</sup>Cointegrated vectors are widely common in political science too. [Ostrom and Smith \[1992\]](#) study presidential approval, [Krause \[1997\]](#) tests whether voters have prospective or retrospective expectations, [Fish and Choudhry \[2007\]](#) study the relationship between democratization and economic liberalization, [Haber and Menaldo \[2011\]](#) study the relationship between natural resource ownership and authoritarianism, [Sobel and Coyne \[2011\]](#) study the relationship between persistence and institutional change, [Herzer and Vollmer \[2012, 489\]](#) “estimate the long-run effect of income inequality on per-capita income,” and [Blaydes and Kayser \[2011\]](#) study caloric consumption and regime type.

<sup>73</sup>Formal statistical tests are required to determine the order of integration and cointegration. In this paper I do not get into the *fractional* (co)integration debate (see [Lebo et al. \[2000\]](#) and [Grant and Lebo \[2016\]](#)). Though the most commonly used unit root tests are the Dickey-Fuller and its augmented version ([Ostrom and Smith \[1992, 149\]](#)), I use additional tests since all of them are low-powered tests.

<sup>74</sup>See [Phillips \[1987\]](#), [Phillips and Perron \[1988\]](#).

<sup>75</sup>See [Kwiatkowski et al. \[1992\]](#).

<sup>76</sup>I show the test statistic and its associated MacKinnon approximate p-value in parenthesis for the ADF and Phillips-Perron tests. Both trend and drift were tested in all tests, when applicable. As I did not find any differences, I show the test statistic with no trend nor drift and one lag. The lags in the KPSS test were selected via an automatic procedure. The critical values for the KPSS test are 10%: 0.119; 5%: 0.146; 2.5%: 0.176; 1%: 0.216. “+” indicates that the test is barely significant or non-significant. The null hypotheses are the following: for the KPSS, the series are trend stationary.

<sup>77</sup>[Keele et al. \[2016\]](#).

<sup>78</sup>I use VAR regressions, which do not necessarily need cointegrated vectors (see [Box-Steffensmeier et al. \[2014, 161, 164\]](#)). Cointegration, however, is important from a substantive standpoint.

1, I focus on the **trace** statistic which calculates the *minimum* number of cointegrated relationships. Define the **trace** statistic as follows:

$$\lambda_{\text{Trace}} = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i) \quad (1)$$

where  $r$  is the rank of the system, i.e. the number of cointegrating relationships,  $\lambda_i$  represents an eigenvalue for each variable in the system and  $T$  is the number of usable observations.<sup>79</sup> The statistic tests the hypothesis that the number of cointegrating vectors is less than or equal to  $r$ . As specified by Johansen [1988], **different unit root tests were considered**.<sup>80</sup> I expect to find evidence of cointegration only in the ‘developed’ cases. Table 2 indicates that all ‘developed’ and ‘semi-developed’ countries have cointegration, while ‘less developed’ countries do not have cointegration. Substantively, what this suggests is two folds. First, economic development requires participation of two efficient sectors. Second, and moreover, balanced sectoral growth leveled out the originally restricted political landscape by empowering industrial elites and consequently facilitating the inclusion of a new group with different political and economic preferences.

Cointegrated time-series need a special method to be estimated. If traditional methods are used, given the interdependent relationship of these kinds of time-series, the results will be affected by the ‘spurious regression’ problem.<sup>81</sup> Cointegration necessarily “implies a particular kind of model,”<sup>82</sup> which could be the two-step procedure error correction model (ECM) or the Johansen’s vector-autoregressive method (VAR). Beck [1992, 244] argues that with less than 100 observations “the two-step procedure will not be optimal.” Consequently, I will estimate the time-series using the vector-autoregressive approach (VAR) specified in Johansen [1988] which among several advantages, it is estimated via MLE.<sup>83</sup> One such advantage is that VAR models do not need to specify the number of cointegrated vectors as opposed to error correction models.<sup>84</sup> Formally, I will model the next reduced form VAR,<sup>85</sup> one per country, both before and after the income tax law was passed:

$$\begin{aligned} \Delta M_{t_m} &= \alpha_m + \beta_m \Delta M_{t-l} + \beta_m \Delta A_{t-l} + \epsilon_{t_m} \\ \Delta A_{t_a} &= \alpha_a + \beta_a \Delta M_{t-l} + \beta_a \Delta A_{t-l} + \epsilon_{t_a} \end{aligned} \quad (2)$$

where  $\epsilon_{t_m} = \epsilon_{t_a} = 0$ , their variances are time invariant, and each individual term are not serially correlated, however they are in the VAR system, which is an advantage since if one equation is

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<sup>79</sup>Box-Steffensmeier et al. [2014, 165].

<sup>80</sup>Since I am interested in the long-run inter-sectoral relationship, I do not split the sample in two.

<sup>81</sup>Ostrom and Smith [1992, 142-143].

<sup>82</sup>Wooldridge [2002, p. 571].

<sup>83</sup>Johansen [1988, 231-232] explains that the “reason for expecting the estimators to behave better than the regression estimates is that they take into account the error structure of the underlying process, which the regression estimates do not.”

<sup>84</sup>Box-Steffensmeier et al. [2014, 164].

<sup>85</sup>“A reduced form VAR expresses each variable as a linear function of its own past values, the past values of all other variables being considered and a serially uncorrelated error term.” In Stock and Watson [2001, 102].

Country	Number of Cointegrated Vectors (rank)	Restrictions	Lags	Log-Likelihood	Trace
Chile	at least 1		5	-1665.9736	0.3799
Argentina	at least 1		3	-1802.292	4.7657
Colombia	at least 1		2	-1805.6773	10.0076
Mexico	at least 1		4	-1978.1322	1.0274
Nicaragua	at least 0		2	-1020.221	11.5297
Guatemala	at least 0		3	-859.2802	16.5493

**Table 2:** *Johansen Tests for Cointegration*

shocked, the other one should respond to such shock.<sup>86</sup> This will be relevant when I discuss impulse response functions. Notice that in both equations the different dependent variables are expressed as a function of the *same* set of lagged independent variables. Since the number of lags  $l$  varies by country *and* time-span (i.e. before/after the income tax law), the system of equations in Equation 2 is in standard form.<sup>87</sup> Table A3 in the Appendix section describes the optimal lags specified in each country regression.<sup>88</sup> The table also shows a summary of different post-estimation tests when the optimum lag length specified in the table was used, including the Lagrange multiplier (LM) test for autocorrelation in the residuals, different tests for normally distributed disturbances, and a test for the VAR system's stability condition. A check mark indicates that the tests was passed successfully, a check-minus mark indicates that the test was passed somewhat successfully, and a cross mark denotes failure to reject specification problems.<sup>89</sup> Finally, since all variables are nonstationary (see Table A2), I take the first difference. Most tests give satisfactory results. It is important to note that the Granger-causality tests in Table 1 were computed via the VAR model specified in Equation 2.

Given that "it is often difficult to draw any conclusions from the large number of coefficient estimates in a VAR system,"<sup>90</sup> econometricians usually turn to analyses of *impulse response functions* (IRFs), which are derived from VAR analyses.<sup>91</sup> "Impulse responses trace out the response of current and future values of each of the variables to a one-unit increase in the current value of one of the VAR errors."<sup>92</sup> In other words, IRFs show via a forecasting process what happens with the dependent variable of one of the equations in Equation 2 once the independent variables of the *other* equation are 'shocked' by a one-unit increase. After fitting the model, I computed and plotted country-specific IRFs for both before and after the imposition of the income tax law. Figure 2 shows four panels for each of the six countries, one for the response of agriculture to industrial growth

<sup>86</sup>Box-Steffensmeier et al. [2014, 108].

<sup>87</sup>Hence the difference operator ( $\Delta$ ).

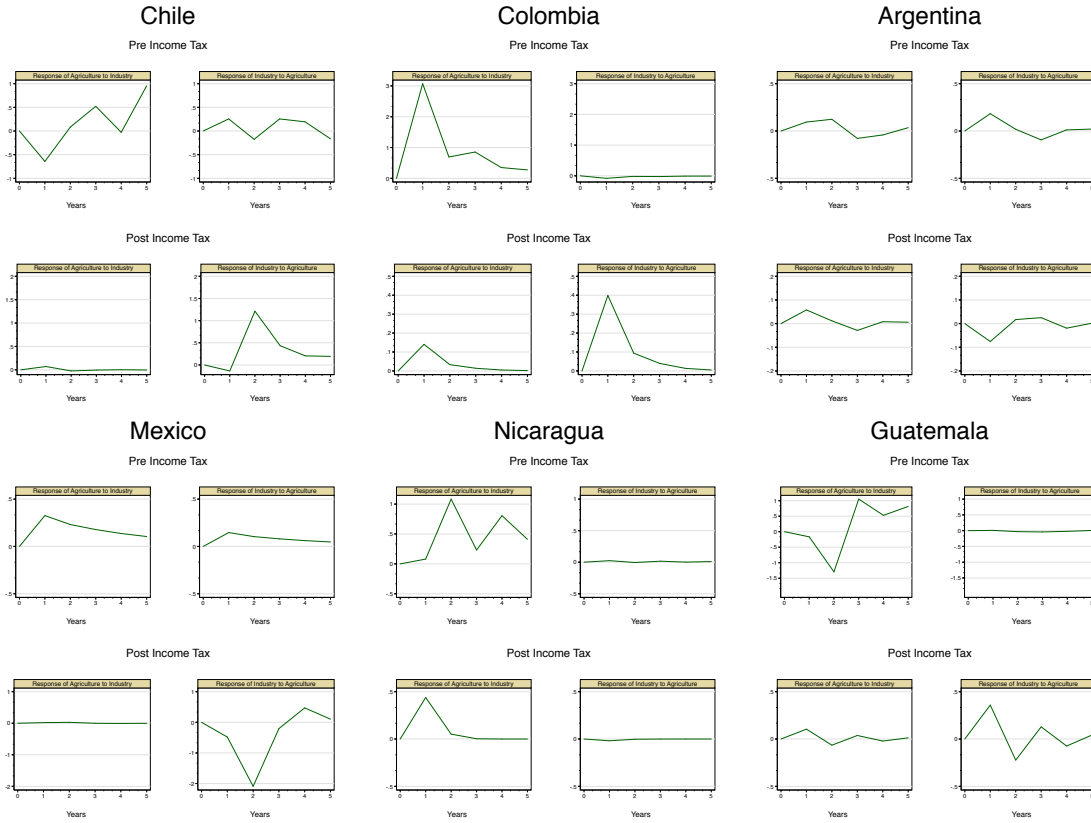
<sup>88</sup>The next information criteria were used to determine the appropriate lag length: final prediction error, AIC, Schwarz's Bayesian information criterion, Hannan and Quinn criterion as well as the corresponding likelihood-ratio test statistics. The same criteria are used to compute the optimal lag length in Table 2.

<sup>89</sup>Detailed results are available upon request.

<sup>90</sup>Lütkepohl and Krätzig [2004, 159].

<sup>91</sup>Raw VAR regression tables are available upon requests.

<sup>92</sup>Stock and Watson [2001, 106]. See also Lütkepohl [2005, 51].



**Figure 2:** *VAR Impulse Response Functions: Sectoral Responses to Each Other's Growths*

(left column), one for the response of industrial growth to agricultural growth (right column), both before (top row) and after (bottom row) the income tax. Similar to the Granger-causality tests, I expect politically ‘developed’ countries to have gone through a process of structural transformation reverting the initial backwards development trap. However, this time I am able to observe the intensity of the responses and how long they take to die out. The X-axis are years, and represent any year (since this is a forecasting-based technique). The Y-axis is *not* growth, but response to equilibrium. That is, the reaction of one sector once the other one is shocked. That is why the “shape of the [IRFs] indicate [...] the dynamic responses of the variables [and since the variables] are  $I(0)$  the impulse responses [...] should converge to zero.”<sup>93</sup>

Impulse response functions in [Figure 2](#) suggest that all ‘developed’ countries switched from a backwards equilibrium to a modern economic growth strategy after the income tax was implemented. For example, agricultural growth in Chile before the income tax was nurtured by industrial development, suggesting that political institutions were oriented to channel all economic resources in a way such that to give advantage to the agricultural sector and the landed elites. The shape of

<sup>93</sup>Enders [2014, 364].

the responses clearly indicates that though industrial growth was produced, the agriculture sector grew faster, taking longer to die out and come back to equilibrium. This situation was reverted after the income tax law. Colombia shows a similar pattern. In Mexico we see that before the income tax, both elites had similar responses, suggesting a more established industrial sector, which is very likely due to the very late implementation of the income tax (1965, see [Table A1](#)). However, after the tax was implemented, the agricultural sector was less responsive to industrial development, suggesting a failure of the landed elites to reinvest gains in more efficient techniques, eventually compromising proper development of the industrial sector. While the analyses on the Argentinean case suggest that there is a long-term inter-sectoral relationship ([Table 2](#)), according to [Figure 2](#) (and [Table 1](#)) this relationship is weak and lacks a clear pattern. As I discuss [later](#), the development of the agricultural sector was compromised by biased pro-industrialization policies that endangered a natural and endogenous process of reallocation of resources that lead to modernization. Nicaragua and Guatemala are the prototypical backward cases. In each case, the economy was *designed* to develop the agricultural sector completely at the expenses of the industrial sector. This goes in line with the null findings of cointegration in [Table 2](#) and Granger-causality tests in [Table 1](#). In these cases an *unbalanced* economic growth did not produce a strong challenger (an industrial political elite), perpetuating the political monopoly of the landowning class. This suggests that the income tax was not product of an inter-elite compromise. This also goes in line with previous findings.<sup>94</sup> Though all countries eventually implemented the tax, there had to be an efficient industrial sector and a strong and cohesive industrial elite for the income tax to produce the structural transformation.

Could this have happened to Mexico too?

## V. DISCUSSION

work in progress.

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<sup>94</sup>[Bahamonde \[2017\]](#).

## VI. APPENDIX

Country	Available Data	Year Income Tax	Law	Source
Chile	1900 - 2009	1924	<i>Ley 3996</i>	Mamalakís [1976, 20] and <a href="#">LeyChile.Cl</a> (official)
Colombia	1900 - 2009	1935	<i>Ley 78</i>	<a href="#">Figueroa [2008, 9]</a>
Argentina	1900 - 2010	1933	<i>Ley 11682</i>	<a href="#">Infoleg.Gob.Ar</a> (official)
Mexico	1900 - 2009	1965	<i>Ley de Impuesto sobre la Renta</i>	<a href="#">Díaz González [2013, 130-133]</a> and <a href="#">Diario Oficial</a> (official)
Nicaragua	1920 - 2009	1974	<i>Ley 662</i>	<a href="#">Legislacion.Asamblea.Gob.Ni</a> (official)
Guatemala	1920 - 2009	1963	<i>Decreto 1559</i>	<a href="#">Instituto Centroamericano de Estudios Fiscales [2007, 165]</a>

**Table A1:** *Sample, Data Available and Year the Income Tax was Implemented*

Country	Time Frame	Sector	Augmented Dickey-Fuller	Phillips-Perron	KPSS	Conclusion
Chile	Pre	Agriculture	-1.185 (0.68)	-1.241 (0.66)	.107 <sup>+</sup>	I(1)
		Industry	2.310 (0.99)	2.556 (0.99)	.113 <sup>+</sup>	I(1)
	Post	Agriculture	4.557 (1.00)	5.40 (1.00)	.289	I(1)
		Industry	0.908 (0.99)	1.458 (0.99)	.249	I(1)
	All	Agriculture	5.521 (1.00)	6.722 (1.00)	.31	I(1)
		Industry	1.582 (0.99)	2.305 (0.99)	.314	I(1)
Colombia	Pre	Agriculture	2.709 (0.99)	2.414 (0.99)	.204	I(1)
		Industry	2.103 (0.99)	3.257 (1.00)	.183	I(1)
	Post	Agriculture	2.392 (0.99)	3.156 (1.00)	.282	I(1)
		Industry	0.520 (0.98)	1.044 (0.99)	.241	I(1)
	All	Agriculture	4.256 (1.00)	5.893 (1.00)	.372	I(1)
		Industry	1.674 (0.99)	2.707 (0.99)	.374	I(1)
Argentina	Pre	Agriculture	-0.849 (0.80)	-1.201 (0.67)	.0801 <sup>+</sup>	I(1)
		Industry	-0.495 (0.89)	-0.378 (0.91)	.115 <sup>+</sup>	I(1)
	Post	Agriculture	1.197 (0.99)	1.093 (0.99)	.277	I(1)
		Industry	0.228 (0.97)	0.381 (0.98)	.0901 <sup>+</sup>	I(1)
	All	Agriculture	1.484 (0.99)	1.401 (0.99)	.332	I(1)
		Industry	1.007 (0.99)	1.237 (0.99)	.183	I(1)
Mexico	Pre	Agriculture	4.601 (1.00)	5.552 (1.00)	.288	I(1)
		Industry	5.803 (1.00)	10.776 (1.00)	.29	I(1)
	Post	Agriculture	0.599 (0.9876)	0.497 (0.99)	.109 <sup>+</sup>	I(1)
		Industry	-1.255 (0.65)	-0.982 (0.76)	.113 <sup>+</sup>	I(1)
	All	Agriculture	3.431 (1.00)	3.607 (1.00)	.341	I(1)
		Industry	0.672 (0.99)	2.020 (0.99)	.367	I(1)
Nicaragua	Pre	Agriculture	2.473 (0.99)	2.355 (0.99)	.25	I(1)
		Industry	4.958 (1.00)	9.100 (1.00)	.244	I(1)
	Post	Agriculture	-0.154 (0.94)	0.154 (0.97)	.2	I(1)
		Industry	-1.237 (0.6577)	-1.176 (0.68)	.189	I(1)
	All	Agriculture	0.636 (0.99)	0.759 (0.99)	.116 <sup>+</sup>	I(1)
		Industry	-0.164 (0.94)	-0.090 (0.95)	.123	I(1)
Guatemala	Pre	Agriculture	-0.393 (0.91)	-0.343 (0.92)	.0639 <sup>+</sup>	I(1)
		Industry	1.358 (0.99)	1.704 (0.99)	.199	I(1)
	Post	Agriculture	1.786 (0.99)	1.965 (0.99)	.162	I(1)
		Industry	-0.998 (0.75)	-1.352 (0.61)	.0915 <sup>+</sup>	I(1)
	All	Agriculture	3.349 (1.00)	3.714 (1.00)	.321	I(1)
		Industry	0.413 (0.98)	0.017 (0.96)	.288	I(1)

**Table A2:** *Unit Root Tests for Agricultural and Industrial Growth*



Country	Time Frame	Number of Lags	LM	Normally Tests			Stability Condition
				Jarque-Bera	Skewness	Kurtosis	
Chile	Pre	4	✓	✓	✓	✓	✓
	Post	2	✓	✓ <sup>-</sup>	✓ <sup>-</sup>	✓ <sup>-</sup>	✓
Colombia	Pre	1	✓ <sup>-</sup>	✗	✗	✗	✓
	Post	1	✓	✓ <sup>-</sup>	✓ <sup>-</sup>	✓ <sup>-</sup>	✓
Argentina	Pre	2	✓	✓	✓	✓	✓
	Post	2	✓	✓ <sup>-</sup>	✓	✓ <sup>-</sup>	✓
Mexico	Pre	1	✓	✓ <sup>-</sup>	✓ <sup>-</sup>	✓ <sup>-</sup>	✓
	Post	2	✓	✓	✓	✓	✓
Nicaragua	Pre	2	✓	✓ <sup>-</sup>	✓ <sup>-</sup>	✓ <sup>-</sup>	✓
	Post	1	✓	✓ <sup>-</sup>	✓ <sup>-</sup>	✓ <sup>-</sup>	✓
Guatemala	Pre	3	✓	✗	✓ <sup>-</sup>	✓ <sup>-</sup>	✓
	Post	1	✓ <sup>-</sup>	✓ <sup>-</sup>	✓ <sup>-</sup>	✓ <sup>-</sup>	✓

**Table A3:** *Lag Length and Post-Estimation Results*

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