Web Appendix to External Integration, Structural Transformation and Economic Development: Evidence from Argentina 1870-1914 (Not for Publication)[1]

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A.1 Introduction

This appendix contains the technical derivations of expressions reported in the paper, the proofs of propositions and additional supplementary material. Equations in the main paper are referenced by their number (for example (1)), while equations in this web appendix are referenced by the letter A and their number (for example (A.1)).

A.2 Theoretical Model

A.2.1 Proofs of the Propositions

Proposition 1. *There exists a unique general equilibrium.*

Proof. We assume that each location is fully specialized in sector A. Similar steps apply if a location is fully specialized in M or incompletely specialized, and Proposition 2 shows the condition for complete specialization as function of exogenous variables.

Step 1: Solve for $\{r(\ell), w(\ell), P_N(\ell)\}$ using conditions (i) and (ii) from Definition 1. First, using (ii) and (11) evaluated at $i = A$ gives the prices as function of the wage-rental ratio,

$$w(\ell) = z_A(\ell)\,\omega(\ell)^{\alpha_A},$$
$$r(\ell) = z_A(\ell)\,\omega(\ell)^{\alpha_A - 1},$$
$$P_N(\ell) = \frac{z_A(\ell)}{z_N(\ell)}\omega(\ell)^{\alpha_A - \alpha_N}.$$

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Following the steps in 3.6 we reach expression (15), which can be written as follows:

$$\beta_T \left(\frac{u^*}{\widetilde{z}_A(\ell)\,\omega(\ell)^{\alpha_A}} \right)^{1-\sigma} + (1-\beta_T) \left(\frac{u^*}{z_N(\ell)\,\omega(\ell)^{\alpha_N}} \right)^{1-\sigma} = 1. \tag{A.1}$$

Given that $0 < \sigma < 1$, the expression on the left is continuous, strictly decreasing in $\omega(\ell)$, it goes to ∞ as $\omega(\ell)$ goes to 0, and it goes to 0 as $\omega(\ell)$ goes to ∞. Therefore, there is a unique $\omega(\ell)$ consistent with (15).

Step 2: Solve for all quantities in each location given prices. As a first preliminary step, we use (11) evaluated at $i = A$ and $w(\ell) = u^* E(\ell)$ from (i) to write the ratio of the price index in the traded sector to the total price index as follows:

$$\frac{E_T(\ell)}{E(\ell)} = \frac{\omega(\ell)^{-\alpha_A}}{\widetilde{z}_A(\ell)} u^*, \tag{A.2}$$

$$\frac{P_N(\ell)}{E(\ell)} = \frac{\omega(\ell)^{-\alpha_N}}{z_N(\ell)} u^*. \tag{A.3}$$

Combining (A.2) with (A.1) we obtain (33) and (34) in the text,

$$z_N(\ell) = u^* \omega(\ell)^{-\alpha_N} \left(\frac{1-\beta_T}{1-\widetilde{E}_T(\ell)} \right)^{\frac{1}{1-\sigma}}, \tag{A.4}$$

$$\widetilde{z}_A(\ell) = u^* \omega(\ell)^{-\alpha_A} \left(\frac{\beta_T}{\widetilde{E}_T(\ell)} \right)^{\frac{1}{1-\sigma}}. \tag{A.5}$$

where

$$\widetilde{E}_T(\ell) = \beta_T \left(\frac{E_T}{E} \right)^{1-\sigma}.$$

As a second preliminary step, we solve for factor demand in the non-tradable sector. Using (A.3) and the definition of income per unit of land, $y(\ell) = \left(n(\ell) + \frac{1}{\omega(\ell)} \right) w(\ell)$, demand for non-traded goods in (5) is

$$c_N(\ell) = (1-\beta_T) \left(\frac{\omega(\ell)^{-\alpha_N}}{z_N} u^* \right)^{-\sigma} \left(n(\ell) + \frac{1}{\omega(\ell)} \right) w(\ell). \tag{A.6}$$

In turn, from the Cobb-Douglas production function in the non-traded sector in (6) we have that total labor and land used in the non-traded sector are

$$n_N(\ell) L_N(\ell) = (1-\alpha_N) \frac{c_N(\ell) L(\ell)}{z_N(\ell)} \omega(\ell)^{-\alpha_N}, \tag{A.7}$$

$$L_N(\ell) = \alpha_N \frac{c_N(\ell) L(\ell)}{z_N(\ell)} \omega(\ell)^{1-\alpha_N}, \tag{A.8}$$

where we have imposed market clearing in the non-traded sector (condition (v) of Definition (1)).

Next, we impose the land and labor market clearing conditions (condition (iii) and (iv) of

Definition (1)). Combining (A.6), (A.7), (A.8) for factor demands in the non-traded sector, (10) evaluated at $i = A$ for labor demand in sector A, and the expression for $1 - \widetilde{E}_T$ obtained from (A.4), we reach the following system, in which conditions (iii) and (iv) of Definition (1) can be written respectively as follows

$$\alpha_N \left(1 - \widetilde{E}_T(\ell)\right)\left(n(\ell) + \frac{1}{\omega(\ell)}\right) + \frac{\lambda_A(\ell)}{\omega(\ell)} = \frac{1}{\omega(\ell)}, \tag{A.9}$$

$$(1-\alpha_N)\left(1 - \widetilde{E}_T(\ell)\right)\left(n(\ell) + \frac{1}{\omega(\ell)}\right) + \frac{1-\alpha_A}{\alpha_A}\frac{\lambda_A(\ell)}{\omega(\ell)} = n(\ell), \tag{A.10}$$

where $\lambda_A(\ell) = L_A(\ell)/L(\ell)$ is the land share in agriculture. Adding up these two equations, we find

$$\frac{\lambda_A(\ell)}{\omega(\ell)} = \alpha_A \widetilde{E}_T(\ell)\left(n(\ell) + \frac{1}{\omega(\ell)}\right).$$

Replacing this back in (A.9) we obtain (21) and (22) in the paper, as well as

$$\lambda_A(\ell) = \frac{\widetilde{E}_T(\ell)\,\alpha_A}{\left(1 - \widetilde{E}_T(\ell)\right)\alpha_N + \widetilde{E}_T(\ell)\,\alpha_A}.$$

Since we have shown that $\omega(\ell)$ is uniquely determined and, given $E_T(\ell)$, u^*, and $\omega(\ell)$, so is $\widetilde{E}_T(\ell)$ from (A.2), we have constructed the unique local equilibrium given u^* and the prices of tradable goods for each location ℓ.

Step 3: Impose no-arbitrage (condition (vi) of Definition (1)) and find the unique u^* that solves labor market clearing (condition (vii) of the equilibrium). First, combine (21) and (22) to express population density as

$$n(\ell) = \frac{(1-\alpha_A)(1-\alpha_N)}{\alpha_N(1-\alpha_A) + (\alpha_A - \alpha_N)\nu_A(\ell)}\frac{1}{\omega(\ell)}. \tag{A.11}$$

Using (A.1) and (22), we can express the infinitesimal change in the log $n(\ell)$ and $\nu_A(\ell)$ as function of the changes in $\omega(\ell)$ and $\frac{E_T(\ell)}{E(\ell)}$:

$$\widehat{n}(\ell) = -\frac{(\alpha_A - \alpha_N)\nu_A(\ell)}{\alpha_N(1-\alpha_A) + (\alpha_A - \alpha_N)\nu_A(\ell)}\widehat{\nu}_A(\ell) - \widehat{\omega}(\ell), \tag{A.12}$$

$$\widehat{\nu}_A(\ell) = \frac{(1-\alpha_A) + (\alpha_A - \alpha_N)\nu_A(\ell)}{1-\alpha_A}(1-\sigma)\left(\widehat{\frac{E_T(\ell)}{E(\ell)}}\right). \tag{A.13}$$

In turn, from (A.1) and (A.2) we can express the total derivative of $\ln\omega(\ell)$ and $\ln\left(\frac{E_T(\ell)}{E(\ell)}\right)$ as (25) and (26). Therefore, keeping the productivities $\{\widetilde{z}_A(\ell), z_N(\ell)\}$ constant, we obtain:

$$\widehat{\omega}(\ell) = \frac{(1-\alpha_A) + (\alpha_A - \alpha_N)\nu_A(\ell)}{\alpha_A(1-\alpha_N)\nu_A(\ell) + \alpha_N(1-\alpha_A)(1-\nu_A(\ell))}\widehat{u^*} \tag{A.14}$$

$$\widehat{\left(\frac{E_T(\ell)}{E(\ell)}\right)} = -\frac{(1-\alpha_A)(1-\nu_A(\ell))(\alpha_A-\alpha_N)}{\alpha_A(1-\alpha_N)\nu_A(\ell) + \alpha_N(1-\alpha_A)(1-\nu_A(\ell))}\widehat{u^*} \tag{A.15}$$

Combining (A.12) to (A.15), we have that:

$$\frac{\widehat{n}(\ell)}{\widehat{u^*}} = \left(\frac{(1-\sigma)(1-\nu_A(\ell))(\alpha_A-\alpha_N)^2\nu_A(\ell)}{\alpha_N(1-\alpha_A)+(\alpha_A-\alpha_N)\nu_A(\ell)} - 1\right)\frac{(1-\alpha_A)+(\alpha_A-\alpha_N)\nu_A(\ell)}{\alpha_A(1-\alpha_N)\nu_A(\ell)+\alpha_N(1-\alpha_A)(1-\nu_A(\ell))}.$$

The term is brackets is negative, implying that $\frac{\widehat{n}(\ell)}{\widehat{u^*}} < 0$. Therefore, population density is strictly decreasing with the real wage in every location. Moreover, since $\nu_A(\ell) \in (0,1)$ the first term in (A.11) is bounded. Using from (A.1) that $\lim_{u^*\to\infty}\omega(\ell) = \infty$ and $\lim_{u^*\to 0}\omega(\ell) = 0$, this implies that $\lim_{u^*\to\infty} n(\ell) = 0$ and $\lim_{u^*\to 0} n(\ell) = \infty$. Aggregate labor demand $\sum_{\ell\in\mathcal{L}} L(\ell)n(\ell)$ inherits these properties, implying that there is a unique u^* consistent with aggregate labor-market clearing (condition (vii) of Definition (1)). □

Proposition 2. *If location ℓ trades, it is either fully specialized in Agriculture, in which case $\omega_A(\ell) < \omega^a(\ell)$, or fully specialized in Manufacturing, in which case $\omega_M(\ell) < \omega^a(\ell)$. Complete specialization in Agriculture occurs for sufficiently high $z_A(\ell)$.*

Proof. If location ℓ trades, it takes the prices of traded goods $\{P_g(\ell)\}_{g=1}^{G}$, $P_M(\ell)$ as given. Condition (ii) of Definition (1) then implies that region ℓ has positive output in sector j only if $j \in \arg\min_{i=A,M,N}\{\omega_i(\ell)\}$. The Inada condition implies that $N \in \arg\min_{i=A,M,N}\{\omega_i(\ell)\}$. Hence, if location ℓ has positive output in sector $i = A, M$, the wage-rental ratio is equals the unique $\omega_i(\ell)$ that solves (14), which we can write

$$\left[\beta_T(\tilde{z}_i(\ell)\,\omega_i(\ell)^{\alpha_i})^{\sigma-1} + (1-\beta_T)(z_N(\ell)\omega_i(\ell)^{\alpha_N})^{\sigma-1}\right]^{\frac{1}{\sigma-1}} = u^*$$

where $\tilde{z}_i(\ell) = \frac{P_i(\ell)}{E_T(\ell)} z_i(\ell)$. Therefore, the location is either fully specialized in agriculture when $\omega_A(\ell) < \omega_M(\ell)$, or fully specialized in manufacturing if $\omega_M(\ell) < \omega_A(\ell)$. Taking the total derivative of $\omega_A(\ell)$ with respect to $\tilde{z}_A(\ell)$ and using (11), we have

$$\widehat{\omega_A}(\ell) = -\frac{\widetilde{E}_T(\ell)\,\widehat{\tilde{z}_A}(\ell)}{\left(1-\widetilde{E}_T(\ell)\right)\alpha_N + \widetilde{E}_T(\ell)\,\alpha_A} < 0.$$

Since $\omega_M(\ell)$ is independent of $z_A(\ell)$, if $z_A(\ell)$ is sufficiently low, then $\omega_A(\ell) < \omega_M(\ell)$. Additionally, if $\omega_A(\ell) = \omega_M(\ell)$, then (11) implies that both are equal to $\omega^a(\ell)$. Hence, if $\omega_A(\ell) < \omega_M(\ell)$, then $\omega_A(\ell) < \omega^a(\ell)$. □

Proposition 3. *If traded and non-traded goods are complements ($\sigma < 1$) and agriculture is more* *land-intensive than non-traded activities, ($\alpha_A > \alpha_N$), then high trade-cost locations (locations ℓ with higher transport costs $\delta(\ell,\ell')$ and hence lower $\widetilde{z}_A(\ell)$) have **(a)** higher wage-rental ratios (higher $\omega(\ell)$), **(b)** lower relative prices of non-traded goods (higher $E_T(\ell)/E(\ell)$), **(c)** lower population densities (lower $n(\ell)$), and **(d)** larger shares of labor in agriculture (larger $\nu_A(\ell)$).*

Proof. Equations (25) and (26) imply (a) and (b). Results (c) and (d) follow by inspection of (21) and (22) . □

Proposition 4. *Reductions in external and internal trade costs that raise a location's adjusted agricultural productivity ($\widehat{\widetilde{z}}_A(\ell)$) **(a)** reduce its wage-rental ratio (lower $\omega(\ell)$), **(b)** increase its relative price of the non-traded good (lower $E_T(\ell)/E(\ell)$), **(c)** raise its population density (higher $n(\ell)$), **(d)** reduce its share of labor in agriculture (lower $\nu_A(\ell)$), and hence **(e)** increase its urban population share.*

Proof. Equations (25) and (26) imply (a) and (b). Results (c) and (d) follow by inspection of (21) and (22) . □

A.3 Additional Theoretical Results

A.3.1 Specialization on the Extensive Margin

As mentioned in footnote 30 in the paper, if transport costs differ across goods and increase with distance to ports, the model implies that more remote regions export a narrower range of products than more centrally-located regions, because transport costs are a source of comparative advantage.

To see this, consider a set of locations with identical technologies, $T_g(\ell) = T_g$ and $\theta(\ell) = \theta$, and suppose that ℓ indexes distance to the nearest port. Then, as distance ℓ increases, the share of land allocated to good g defined in (17) varies as follows:

$$\frac{l_g'(\ell)}{l_g(\ell)} = \theta\left(\frac{P_g'(\ell)}{P_g(\ell)} - \sum_{h=1}^{G}\frac{P_h'(\ell)}{P_h(\ell)} l_h(\ell)\right).$$

Assume iceberg trade costs τ_g for each good, order goods such that $\tau_1 < \tau_2 < .. < \tau_G$, and suppose that all goods are shipped internally. If the prices are determined by no-arbitrage with the port then $P_g(\ell) = P_g^* e^{-\tau_g \ell}$. This implies that $\frac{l_g'(\ell)}{l_g(\ell)} > 0 \longleftrightarrow \tau_g < \overline{\tau_g}(\ell)$, where $\overline{\tau_g} = \sum_h \tau_h l_h(\ell)$, i.e., as we move inland, comparative advantages strengthen for goods with lower transportation costs and weaken for goods with high transportation costs.

If all prices were determined by no-arbitrage with the port, we would have that $\overline{\tau_g}'(\ell) < 0$ and $\overline{\tau_g} \to \tau_1$. Hence, for each good $g > 1$ there would be a threshold $\overline{\ell}_g$ above which its land share is decreasing, $\frac{l_g'(\ell)}{l_g(\ell)} < 0 \longleftrightarrow \ell > \overline{\ell}_g$, where $\overline{\ell}_G < \overline{\ell}_{G-1} < .. < \overline{\ell}_2$. Each good $g > 2$ would not be exported for all $\ell > \overline{\ell}_g^* > \overline{\ell}_g$, where $l_g'\left(\overline{\ell}_g^*\right) = \gamma_g$, and there would be some $\overline{\ell}_1$ such that only $g = 1$

is exported for all $\ell > \bar{\ell}_1$. Hence, under heterogeneous iceberg costs, the number of exported goods decreases toward the interior and, as ℓ increases, goods with higher τ_g are dropped.

A.3.2 Extended Model with Endogenous Land Use

In the model, all land is used productively. Therefore in our empirical analysis we use geographical land area as our measure of land area in the model. Here, we develop an extension of the model in which landowners make an endogenous decision whether to leave land wild or convert it to productive use. In this extension, the amount of land used in each location is also endogenous.

In our baseline version of the model in the paper, the zero populations observed for some locations in the data are rationalized by zero productivities in tradables: $z_A(\ell) = z_M(\ell) = 0$. In this extension of the model, a location may also have zero population because it is not profitable to convert land to productive use.

Now, we use $\overline{L}(\ell)$ to denote the total land area of each location, and $L(\ell)$ to denote the land area that is used productively. The only extension to the baseline model is the following: each land plot $j \in \overline{L}(\ell)$ requires a fixed cost of f_j units of labor to be opened and maintained for productive use. Once opened, the specialization across sectors and goods within agriculture is the same as in the baseline model. The cost f_j is independently and identically distributed across land plots and districts. We let $G_f(x)$ be the share of land plots in each district whose cost f is less than x.

Conditional on a land plot being open for productive use, we can solve (8) and (9) as before. From the solution to this problem, we obtain the expected (gross) land rents from using any land plot j for production in sector i,

$$r_i(\ell) = \bar{f}_i(\ell)\, w(\ell),$$

where $\bar{f}_i(\ell)$ is defined identically to the inverse of $\omega_i(\ell)$ in (11). If a location is specialized in agriculture, $\bar{f}(\ell)$ equals the inverse of $\omega(\ell)$ from (15). Net rents to the landowner of plot j are then

$$r_j(\ell) = \left(\bar{f}(\ell) - f_j\right) w(\ell),$$

where land is converted to productive use if these net rents are positive. The total amount of land used can be expressed as:

$$L(\ell) = G_f\left(\bar{f}(\ell)\right) \overline{L}(\ell).$$

The determination of $\bar{f}(\ell)$ is independent from the amount of land that is used, and therefore from the support of the fixed-cost distribution $G_f(x)$. Therefore, as long as the support of this distribution is bounded from below by some positive number, we will have $L(\ell) = 0$ for sufficiently low $\omega(\ell)$.

While this extension does not affect gross returns to land and labor (i.e., **Step 1** in the proof of Proposition 1), it does affect the model prediction for population density and for the agricultural labor and land share. Following steps similar to **Step 2** in the proof of Proposition 1 we reach the following solutions for (21) and (22):

$$n(\ell) = \frac{N(\ell)}{L(\ell)} = \left(\frac{1}{\alpha_N + (\alpha_A - \alpha_N)\widetilde{E}_T(\ell)} - 1 \right) \overline{f}(\ell) + \mathbb{E}\left[f \mid f < \overline{f}(\ell) \right], \tag{A.16}$$

and

$$\nu_A(\ell) = \frac{N_A(\ell)}{N(\ell)} = \frac{\widetilde{E}_T(\ell)\left(\alpha_A \mathbb{E}\left[f \mid f < \overline{f}(\ell) \right] + (1-\alpha_A)\overline{f}(\ell)\right)}{\left(\alpha_N + \widetilde{E}_T(\ell)(\alpha_A - \alpha_N)\right)\left(\mathbb{E}\left[f \mid f < \overline{f}(\ell) \right] - \overline{f}(\ell)\right) + \overline{f}(\ell)}. \tag{A.17}$$

where $\widetilde{E}_T(\ell) \equiv \beta_T \left(\frac{E_T(\ell)}{E(\ell)} \right)^{1-\sigma}$. It can be verified that these expressions nest (21) and (22) for the case without fixed costs, in which $\mathbb{E}\left[f \mid f < \overline{f}(\ell) \right] = 0$.

A.4 Additional Empirical Results

In this section of the appendix, we report additional empirical results discussed in the main paper. Figures 3-5 of the paper show the evolution of the spatial distribution of population in 1869, 1895 and 1914. Figures 13-15 in this web appendix show the evolution of the spatial distribution of urban population shares over time. As shown in Figure 13, high urban population shares in 1869 were concentrated around Buenos Aires and the Spanish colonial towns that served the mining region of Upper Peru. As shown in Figures 14 and 15 in the web appendix, these high urban population shares radiate outwards from Buenos Aires in 1895 and 1914 with the development of its agricultural hinterland. As shown in Figure 16 in this web appendix, high urban population shares also go together with high shares of employment in non-agricultural activities.

Table 1 of the paper reports changes in the composition of exports across agricultural goods. Figure 17 in this web appendix shows that these changes in export composition are reflected in changes in relative agricultural land allocations, with a marked rise in Cereals agricultural area from 1895-1914. Table 2 of the paper reports the shares of agricultural machinery in imports. Figure 18 in this web appendix shows the total number of agricultural machines over time (ploughs, mowers, rakes, threshers, water pumps and wind pumps), where the totals displayed in this figure are the sum of the numbers reported for 1895 and 1914 for each district in our census data.

As shown in Section A.2 above, when transport costs differ across goods, the model predicts that more remote locations export a narrower range of products. In Figure 19, we provide empirical evidence on this prediction. We asign customs to the province in which they are located, and display the number of exported products in 1869, 1895 and 1914 for each province, where provinces are sorted by 1914 export values. Consistent with the model's predictions, we find that more geographically remote provinces not only have lower total export values but also on average export a smaller number of products.

A.5 Data Appendix

A.5.1 District boundaries

The unit of analysis is the *partido* or *departamento* (which we refer to as "district" from now on). These districts correspond to the first administrative division within a province (the name *partido* is only used in the province of Buenos Aires, whilst in the other provinces the name *departamento* prevails).

The actual administrative division used in this paper corresponds to the one reported in the 1895 population census, when there were 23 provinces or national territories and 386 districts. The boundaries correspond to those drawn by Cacopardo (1967) with reference to that year. The same publication includes maps corresponding to the administrative divisions in place in 1869 and 1914 and a concordance table which links the districts listed in every census between them. Both sets of information – the maps and the table – were used to assign the data contained in the 1869 and 1914 census to constant spatial units based on the districts reported in the 1895 census. The process of reassigning the data is discussed for each variable in turn in the remaining subsections of this appendix.

A.5.2 Urban population

The 1869, 1895 and 1914 censuses all include figures for urban population at the district level. In order to recreate the 1869 and 1914 urban populations of districts within 1895 boundaries the following procedure was carried out:

- When a 1869 or 1914 district was entirely contained within a given 1895 district, the urban population for 1869 and 1914 was entirely assigned to that 1895 district.

- When a 1869 or 1914 district was split among several 1895 districts, the location of the main urban center at each year was established using secondary sources (Google Earth) and it was determined to which 1895 district it belonged. All the urban population reported for the 1869 and 1914 districts was assigned to the 1895 district where the main urban center was located.

A.5.3 Rural population

The 1869, 1895 and 1914 census all include figures for rural population at the district level. In order to recreate the 1869 and 1914 rural populations of districts within the 1895 boundaries the following procedures were carried out:

- When a 1869 or 1914 district was entirely contained within a given 1895 district, the rural population for 1869 and 1914 was entirely assigned to that 1895 district.

- When a 1914 district was split among several 1895 districts, an overlap of the 1895 administrative map with the 1914 administrative map was constructed using GIS software, and it was determined which portion of the 1914 districts corresponded to the 1895 districts. Under the assumption of a uniform density of the rural population within each 1914 district, the 1914 rural population was assigned to the relevant 1895 districts.

- When a 1869 district was split among several 1895 districts, an equivalent method to the one used for the 1914/1895 match was used. Since no 1869 district ceded territory to more than one new 1895 district, it was possible to estimate the portions of each 1869 district that corresponded to a given 1895 district simply by comparing the land extensions reported in 1869 and 1895. Under the assumption of a uniform density of the rural population within each 1869 district, the 1869 rural population was assigned to the relevant 1895 districts.

A.5.4 Aggregate and Customs trade

The trade data was collected from different official publications. For the data correspoding to 1870, it was obtained from the statistical yearbook *Estadísticas de las aduanas de la República Argentina* published by the *Oficina de estadística general de la dirección de aduanas* (the Statistical Office of the Customs Direction). The data includes the quantity and value of the exports (by destination) and imports (by origin) for each custom of the country following a relatively aggregated product classification. For the data corresponding to 1895 and 1914, the same variables were obtained from the statistical yearbook of the *Dirección General de Estadística* (Statistics General Direction). The product classification is different to the one of 1870 and is more disaggregated. A concordance between the different product classifications was constructed to make the data for the three years comparable. Lastly, the geographical coordinates for each custom were determined using Google Earth. The customs were then mapped into our spatial units of analysis, the districts reported in the 1895 census, using GIS software.

A.5.5 Railways lines and stations

The location of the railway lines was established by digitizing the maps of the railway network of Argentina for 1869, 1895 and 1914 included in Randle (1981). The list of stations operating in each year was obtained from *Estadísticas de los ferrocarriles en explotación*, a yearly publication of the *Dirección nacional de ferrocarriles* (National Railways Direction) for 1895 and 1914 and from historical sources for 1869. Two variables were collected for each railway station in the database: its geographical coordinates and its opening date. The geographical coordinates of stations were determined using Google Earth and Wikimapia taking into account changes in station names over time. The stations were then mapped into our spatial units of analysis, the districts reported in the 1895 census, using GIS software. To determine the opening dates of stations, we used the opening date of the section of the railway line on which the station is located. This information is available in *Estadísticas de los ferrocarriles en explotación*. Three dates for each section of a railway line are available: the date when the construction was authorized, the date when the decree opening the section was issued and the actual date when service was started (generally a few months after the issuance of the decree). We used the last date whenever it was available. If this last date was unavailable, the opening decree issuance date was used.

A.5.6 Railway shipments

The railway shipments data comes from *Estadísticas de los ferrocarriles en explotación.* The data is available on a yearly basis for all years starting in 1895. The records include the cargo loaded in almost every station of the network. With respect to the records for the years 1895 and 1914 used in this paper, there is no data for *Ferrocarril Central Córdoba* (Central Córdoba Railway) in 1895 and for the *Ferrocarril Midland* (Midland Railway) in 1914. The classification of products differs somewhat across railway lines. To construct a common product classification, we aggregated similar categories (raw hides, bovine hides, sheep hides, etc.) into broader categories (hides) which were common across railway lines.

A.5.7 Spanish Colonial Sixteenth Century Cities

Table 6 reports the Spanish colonial 16th-century cities used to construct our Route C16 instrument (Randle 1981).

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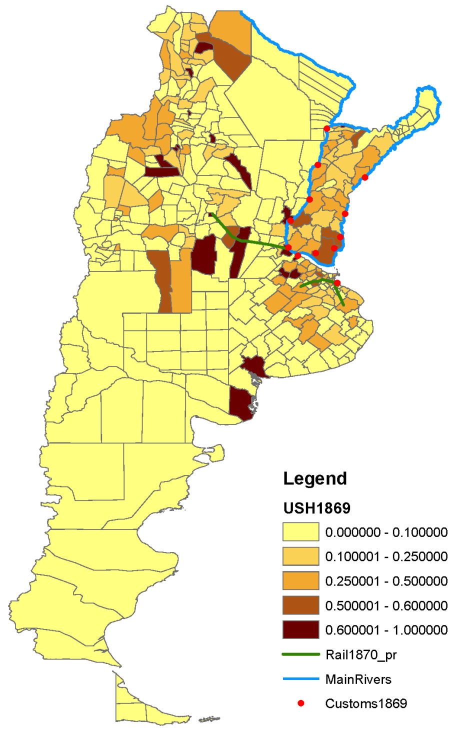

Figure 13: Urban Population Shares 1869

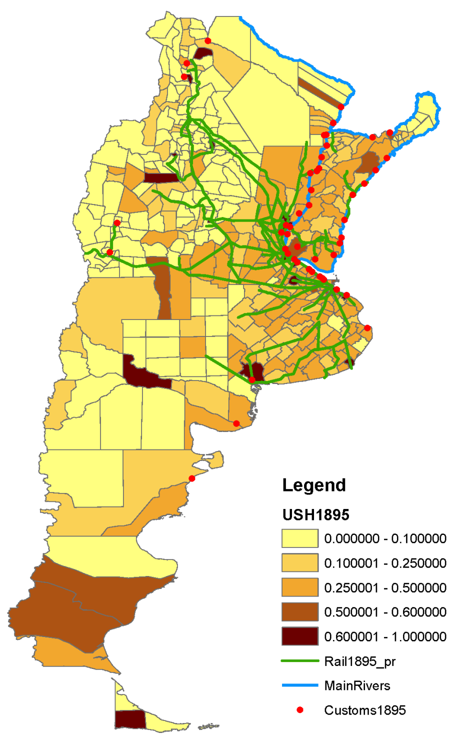

Figure 14: Urban Population Shares 1895

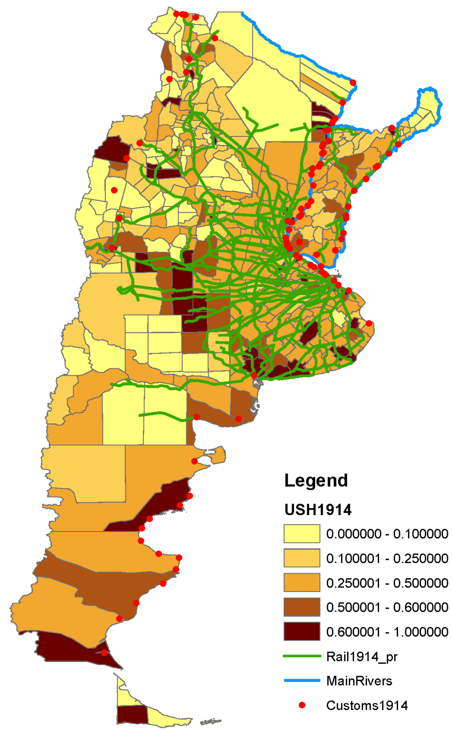

Figure 15: Urban Population Shares 1914

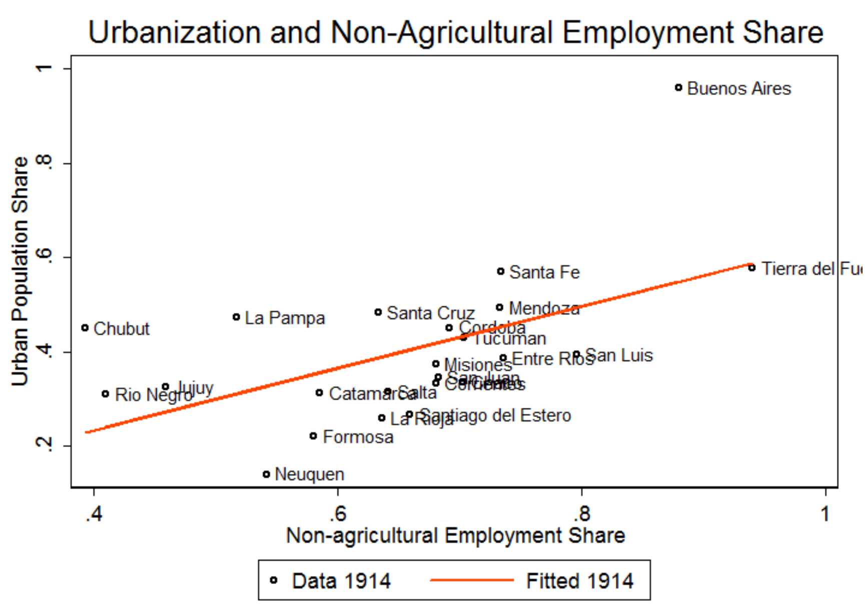

Figure 16: Province Urban Population Share and Non-Agriculture Employment Shares 1914

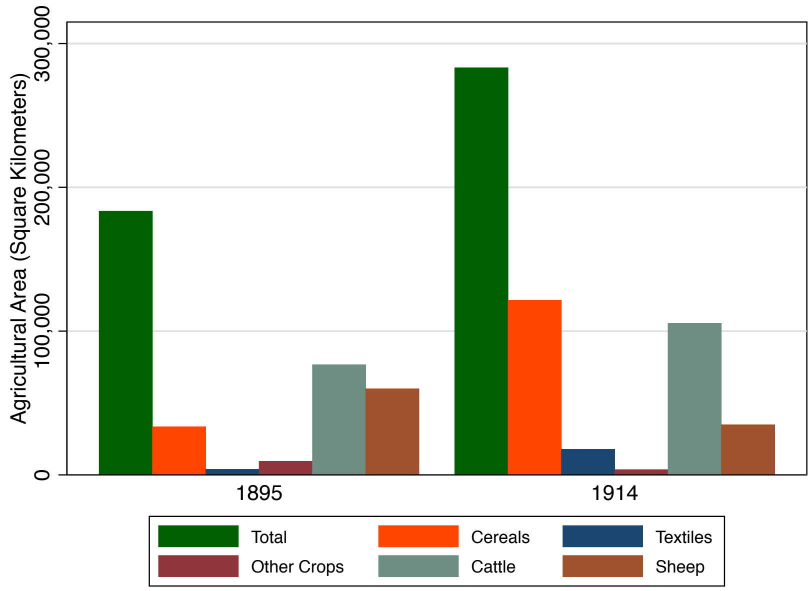

Figure 17: Agricultural Land Area in 1895 and 1914

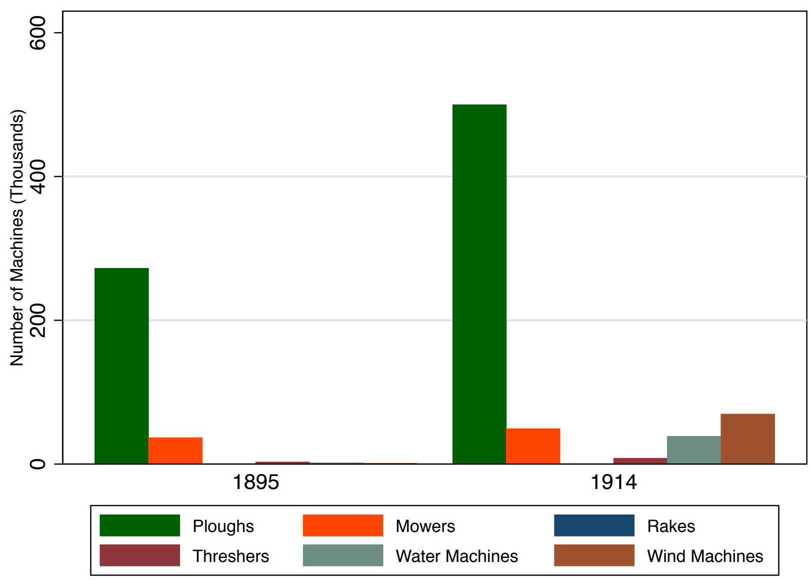

Figure 18: Agricultural Machinery in 1895 and 1914

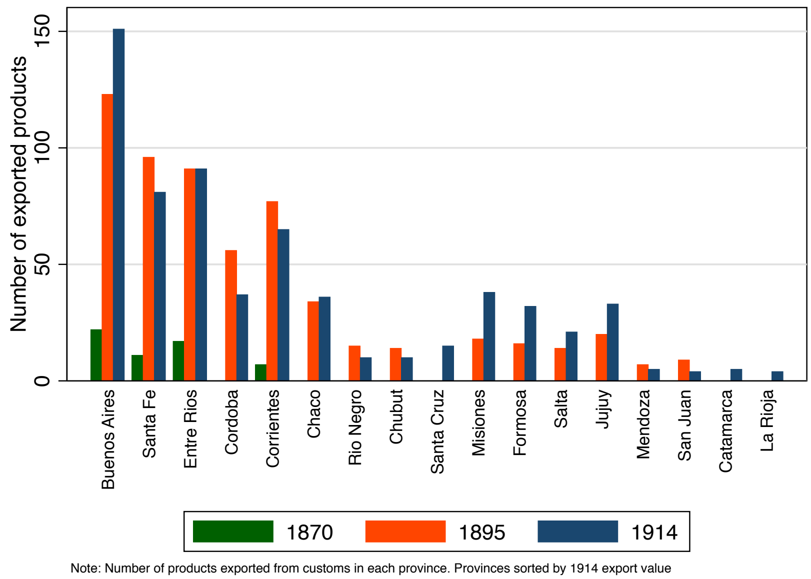

Figure 19: Province Export Values and Number of Exported Products

Province	**Name**	**Year Founded**
Buenos Aires	Buenos Aires	1580
Buenos Aires	Santa María del Buen Ayre	1536
Catamarca	Londres	1558
Catamarca	San Pedro de Mercado de Andalgalá	1582
Chaco	Matará y Guacará	1585
Chaco	Nuestra Señora de la Concepción del Bermejo	1585
Corrientes	Vera en las 7 Corrientes	1588
Córdoba	Alta Gracia	1590
Córdoba	Córdoba	1573
Córdoba	Santa María	-
Córdoba	Santa Rosa de Calamuchita	-
Jujuy	Humahuaca	1596
Jujuy	Nieva	1561
Jujuy	San Francisco de Alava	1575
Jujuy	San Salvador de Jujuy	1593
La Rioja	Todos Santos de La Nueva Rioja	1591
Mendoza	Ciudad de la Resurección de Mendoza	1561
Mendoza	Mendoza	1562
Salta	Córdoba del Calchaquí	1551
Salta	Esteco (Caceres)	1566
Salta	Lerma en el Valle de Salta	1582
Salta	Madrid de Las Juntas	1592
Salta	Metán Viejo	-
Salta	Nuestra Señora de Talavera	1567
Salta	Primera San Clemente de la Nueva Sevilla	1577
Salta	Segunda y Tercera San Clemente de la Nueva Sevilla	1577
Salta	Segundo Barco	1559
San Juan	San Juan de la Frontera	1562
San Luis	San Luis de Loyola	1593
Santa Fe	Corpus Christi	1536
Santa Fe	Nuestra Señora de la Buena Esperanza	1536
Santa Fe	Sancti Spiritus	1527
Santa Fe	Santa Fe (Cayasta)	1573
Santiago del Estero	Santiago del Nuevo Maestrazgo del Estero	1553
Santiago del Estero	Tercer Barco	1552
Tucumán	Amaicha	-
Tucumán	Cañete	1560
Tucumán	El Barco	1550
Tucumán	Quilmes	-
Tucumán	Ranchillos	-
Tucumán	San Miguel de Tucumán	1565

Table 6: Spanish Colonial 16th-Century Cities