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Published in:
European Review of Economic History

DOI:
[10.1093/ereh/hex012](https://doi.org/10.1093/ereh/hex012)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2018

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Nikolić, S. (2018). Determinants of industrial location: Kingdom of Yugoslavia in the interwar period. *European Review of Economic History*, 22(1), 101-133. <https://doi.org/10.1093/ereh/hex012>

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Determinants of industrial location: Kingdom of Yugoslavia in the interwar period

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What determines the location of industry? Using panel data econometrics and a new dataset on interwar Yugoslavia the predictions of three theories—Heckscher-Ohlin, New Economic Geography, and Path Dependence—are quantified and compared. Results show that all three theories mattered and that New Economic Geography forces played a dominant role. The consensus view that several theories can simultaneously explain the distribution of industrial activity is thus reinforced. The main novelty is that Path Dependence can affect the location of industry in addition to Heckscher-Ohlin and New Economic Geography forces.

1. Introduction

What determines the location of industrial activity within a country? Economic theory offers different views on why some locations may be more attractive than others. Neoclassical Heckscher-Ohlin theory proposes that industry will be attracted to locations with a comparative advantage in natural endowments and factors of production (Ohlin 1933). New Economic Geography models stress the interaction of transportation costs with economies of scale and linkage effects in creating geographical concentration of industries (Krugman 1991b).

In the last two decades, there has been a broad range of empirical studies on the relative merit of Heckscher-Ohlin and New Economic Geography in explaining the location of economic activity. Most notably, Midelfart-Knarvik *et al.* (2000, 2001) developed a theoretical model of industrial location based on microeconomic foundations.¹ They used the model to empirically estimate the location of industry in the EU (1970–1997). The model then diffused through the field of Economic History. Crafts and Mulatu (2005, 2006) analyzed what determined the location of British industry (1871–1931) and also studied how the location of British industry responded to falling transportation costs before the First World War. Wolf (2007) researched the relocation of industry in interwar Poland (1926–1934). Klein and Crafts (2012) accounted for the persistence of the Manufacturing Belt in the USA (1880–1920). Martinez-Galarraga (2012) established the determinants of industrial location in Spain (1856–1929). A broad consensus exists in the literature that Heckscher-Ohlin and

¹ See Brühlhart (1998) for a review of the early empirical literature such as the pioneering work of Kim (1995, 1999). Davis and Weinstein (1999, 2003) developed a model that nests both theories, but its main application is to differentiate between the two theories, rather than identify individual drivers of industrial location. Rosés (2003) uses a similar approach. Midelfart-Knarvik *et al.* (2000, p. 65) note that their model is closest to that of Ellison and Glaeser (1999).

New Economic Geography theories are not mutually exclusive but can influence the location of industrial activity simultaneously. [Crafts and Wolf \(2014\)](#) opened a new chapter in the literature by showing that Path Dependence can also help explain industrial location. The present paper contributes to the literature by quantifying and comparing the explanatory power of all three theories—Heckscher-Ohlin, New Economic Geography, and Path Dependence—using panel data econometrics.

The location of industry in interwar Yugoslavia is used as a testing ground for several reasons. Research on the region (South-East Europe) and type of economy (late industrializing) is in short supply. New Economic Geography studies often employ external shocks to identify the mechanisms behind the location of industry ([Redding 2010](#)). The changing of borders following the First World War was a severe shock that brought exogenous variation in the access to markets faced by new Yugoslav territories. From the perspective of New Economic Geography Yugoslavia is thus a particularly well suited case for a study of industrial location determinants.²

2. Exploring industrial location

2.1 *Historical background on border changes, integration and industrial location*

Yugoslavia came into existence in December 1918 following the end of the First World War and the dissolution of various European empires. It was comprised of the previously independent Kingdoms of Serbia and Montenegro (both gained internationally recognized independence from the Ottoman Empire in 1878) and several former Austro-Hungarian lands.³ Territories that came to form Yugoslavia differed in many respects, not least owing to their different heritage from the Austro-Hungarian and Ottoman Empires. At its birth Yugoslavia had four railway systems in operation, five currencies in circulation, five tax systems and six customs areas in place.⁴ Different monetary, fiscal and transport systems were well integrated by the end of 1925.

Fiscal and monetary reforms were implemented with utmost urgency. As early as 1919 common external tariffs for all Yugoslav regions were established by the passing of a new Customs Law ([Ministarstvo finansija 1939](#), p. 107). The first Yugoslav Constitution enacted on 28 June, 1921 was a focal point for reforms of direct taxation as it stipulated regional tax equality (Article 116 of the Constitution) and provided a legal base for future tax laws ([Ministarstvo finansija 1939](#), p. 46).⁵ Key monetary reforms were the establishment of a central bank and common currency. The National Bank of Serbia—the only bank of note

² The Kingdom of Serbs, Croats and Slovenes, established in December 1918, officially changed its name to Kingdom of Yugoslavia in 1929. The conventional term Yugoslavia is used throughout the paper. The following transliteration rule is applied: use common English language translation (e.g., Yugoslavia or Belgrade) when possible and the original (e.g., Vojvodina or Niš) otherwise.

³ Several territories from both parts of Austria-Hungary came to form Yugoslavia. Parts of Carniola and Lower Styria as well as the Kingdom of Dalmatia were former Cisleithanian lands. Kingdom of Croatia-Slavonia and parts of Banat, Bačka, and Baranja were former Transleithanian lands. Bosnia-Herzegovina was jointly administered by both parts of the Dual Monarchy from 1878 and fully annexed in 1908.

⁴ See [Lampe \(1980](#) p. 139), [Narodna Banka Kraljevine Jugoslavije \(1935](#), p. 142), and [Ministarstvo finansija \(1939](#), pp. 43–45).

⁵ For example, several financial tax laws (e.g., Disability Tax (1921), Business Turnover Tax (1922), and the Temporary Tax on all Existing Indirect Taxes (1923)) passed in subsequent years applied to the whole Kingdom.

issue in Yugoslavia—was transformed into the National Bank of Serbs, Croats and Slovenes at the beginning of 1920. The National Bank was given the exclusive right to issue new dinar bank notes and convert residual foreign currencies (mainly Austrian crowns) into new Yugoslav currency ([Narodna Banka Kraljevine Jugoslavije 1935](#), pp. 142, 220).

The reconstruction of the war torn railway network and unification of the inherited transport systems was completed by the end of 1925. In the early post-war years there were several regional railway directorates in Yugoslavia (Belgrade, Ljubljana, Sarajevo, Subotica, and Zagreb) that issued their own regulations (most notably transport tariffs). The New Railway Transport Law enacted in October 1925 provided unified railway regulation and resolved “tariff chaos” ([Cugmus 1929](#), pp. 224–225). The state railway network expanded fast in the first half of the 1920s due to reconstruction and state purchases of private railways.⁶ From 1922 to 1925, the state railway network (for public use) grew from 7,739 to 8,886 km. Until the end of the interwar period an additional 760 km of state railway track intended for public use was constructed ([Kraljevina Jugoslavija 1932–1941](#)).

The integration of fiscal, monetary and transportation systems was conducive for commodity market integration. The average coefficient of variation of commodity prices across ten major Yugoslav cities decreased by a third from 1922 to 1939. Most of the Great Depression period (1929–1934) was however characterized by market disintegration.⁷ Market integration could have affected industrial location by changing the extent of regional specialization. Increased market integration would have brought an increase in regional specialization in industrial activity, save for the depression years in which regional economies could have been more self-subsistent.

2.2 Measuring industrial location

In accordance with the policies of the International Labor Organization the Yugoslav constitution of 1921 guaranteed social security to workers. The 1922 Law on the Protection of Workers regulated employer-worker relations and entrusted the implementation of social insurance to the Central Office for the Insurance of Workers (*Središnji ured za osiguranje radnika*, henceforth SUZOR). In 1932, SUZOR started to report detailed data on the number of insured workers in its monthly journal called Protection of Workers ([Središnji ured za osiguranje radnika 1932–1941](#)).⁸ This publication is the best available source for the measurement of industrial location across interwar Yugoslavia as it reported regionally disaggregated cross-sections on the number of state and privately insured workers across a wide range of economic activities for the period 1932–1939.⁹

SUZOR had 17 regional offices insuring workers in as many different regions. SUZOR data have been aggregated to the 1921 administrative division of Yugoslavia into eight

⁶ The state purchased Southern Railways and railways which belonged to the Orient Railway Society and Ottoman Society. Out of all railways in public use State railways accounted for 90% or more of railways in Yugoslavia from 1925 on [Kraljevina Jugoslavija \(1932–1941\)](#).

⁷ See [Nikolić \(2017\)](#) for a discussion of market integration in interwar Yugoslavia.

⁸ In total 28 sub-sectors of industry and services were covered in the publication. Agriculture and mining were for the most part left out.

⁹ The 1921 census of population does not provide industrial employment data. The 1931 census of population does not provide regionally disaggregated data on the industrial dimension. The only census of Yugoslav interwar industry, taken in 1938 ([Ministarstvo trgovine i industrije 1941](#)), has a regional representation of the data according to *Banovine*—governorships introduced in 1929 which do not allow a meaningful comparison to any other previous or subsequent period.

Map I. *Map of Yugoslavia according to 1921 administrative regions.*

Sources: own GIS map of mainland Yugoslavia based on a map from the 1921 census of population (*Kraljevina Jugoslavija 1932*).

Notes: The eight administrative regions were: Bosnia-Herzegovina, Croatia-Slavonia, Dalmatia, Montenegro, South Serbia, North Serbia, Slovenia, and Vojvodina.

regions—Slovenia, Croatia-Slavonia, Vojvodina, North Serbia, Bosnia-Herzegovina, Dalmatia, South Serbia, and Montenegro (see Map I).¹⁰ The fit of SUZOR regional offices to administrative regions is shown in Map 2. For SUZOR regions spanning across several administrative regions (e.g., Dubrovnik) corrections were necessary before aggregation.¹¹

In addition to SUZOR regional offices there were three large private insurance companies located in the most populous cities of Yugoslavia (Belgrade, Ljubljana, and Zagreb). Compared to state provided insurance private companies played only a minor role as they accounted for less than three percent of total insured industrial workers in any year from 1932 to 1939 (*Središnji ured za osiguranje radnika 1932–1941*). Workers insured by private

¹⁰ Administrative regions can roughly be compared to present day countries. Slovenia, Bosnia-Herzegovina, and Montenegro mostly correspond to the three present day countries of the same name. Present day Croatia resembles the sum of Croatia-Slavonia and Dalmatia. The sum of Vojvodina, North Serbia, and South Serbia is best compared to present day Serbia and Former Yugoslav Republic of Macedonia (FYROM) taken together.

¹¹ Municipal level industrial employment weights (only available from the 1931 Census of Population) were applied to affected SUZOR regions in order to get at municipal level industrial employment values. The values were then re-assigned to the correct administrative regions. The magnitude of the correction was minor—the adjustment was done for 34 out of 344 municipalities total covering circa 6% of total industrial employment in 1931.

Map 2. Map of Yugoslavia showing the fit of SUZOR regional offices to 1921 administrative regions.

Sources: own GIS map based on (*Središnji ured za osiguranje radnika 1932–1941*). 1921 administrative regions as in Map 1.

Notes: The 17 SUZOR regional offices were: Banja Luka, Belgrade (Beograd), Dubrovnik, Karlovac, Ljubljana, Niš, Novi Sad, Osijek, Petrovgrad, Sarajevo, Skoplje, Sombor, Split, Subotica, Sušak, Tuzla, and Zagreb.

companies were added to the corresponding SUZOR regional office (i.e., Belgrade, Ljubljana, or Zagreb).

The industrial dimension consists of ten industrial categories: chemicals; electric power and water supply; food and beverage; leather and rubber (including rubber manufactures); metals and machinery; paper and printing; stone and earth; textiles; tobacco; and wood (including wood manufactures). The aggregation on the industrial dimension was straightforward—it amounted to summing the number of insured industrial workers in the following industries: wood with wood manufactures, paper with printing, and finally leather and rubber with rubber manufactures.¹²

How does SUZOR data compare to other sources of employment data? Census of population for 1931 (*Kraljevina Jugoslavija 1940*) provides data on active population but makes no attempt to distinguish between industry and crafts. SUZOR data are more representative

¹² The aggregation was done so as to maximize the comparability between the dependent and explanatory variables used in econometric estimation (see next section).

Table 1. *Cross-check of SUZOR data on insured industrial workers with Industrial Census data on industrial employees (1938 benchmark)*

Data source Region ^a	SUZOR		Industrial census	
	No.	%	No.	%
Bosnia-Herzegovina	41,560	12.31	31,158	10.36
Croatia-Slavonia	97,258	28.80	86,180	28.67
Dalmatia	10,424	3.09	11,356	3.78
Montenegro	2,167	0.64	292	0.10
North Serbia	61,475	18.21	55,025	18.30
South Serbia	16,315	4.83	3,724	1.24
Slovenia	60,998	18.06	64,472	21.45
Vojvodina	47,476	14.06	48,406	16.10
Yugoslavia	337,673	100	300,613	100

Source: Own calculations based on SUZOR data ([Središnji ured za osiguranje radnika 1932–1941](#)) and Industrial Census data ([Ministarstvo trgovine i industrije 1941](#)).

Notes: “SUZOR data aggregated to historical regions reported in the 1921 Census of Population (e.g., Croatia-Slavonia include the region *Srem*; Vojvodina consists of *Banat*, *Bačka*, and *Baranja*). Industrial Census for 1938 presents the data with the above regional division (note that the source uses the term Serbia 1912 instead of North Serbia).

of true industrial employment as factory workers were more likely to be insured than artisans. In fact, SUZOR data for 1932 covers a third of workers in industry and crafts in 1931.¹³ Industrial Census for 1938 ([Ministarstvo trgovine i industrije 1941](#)) provides data on the regional distribution of workers employed in industry. Table 1 cross-checks the regional distribution of insured and employed industrial workers in 1938. The correlation between the two series is around 98 percent which is strong evidence that data on insured industrial workers are representative of employed industrial workers. Note that the total number of insured industrial workers is larger than the number of employed industrial workers. This can be explained by differences in the industrial composition of regional aggregates¹⁴ and methods of data collection and reporting used by the two sources.¹⁵ Hereafter, the terms insured industrial workers, industrial employment, and industrial activity are used interchangeably.

2.3 Describing industrial location

Table 2 shows the distribution of insured industrial workers across industries and regions as an 1932–1939 average (expressed in percentages). Because regions differed greatly in terms of population (see the bottom row of table 2), the data shown is population weighted. The eight regions of Yugoslavia are ordered according to their share in Yugoslav industrial

¹³ In turn, industry and crafts accounted for circa eleven percent of total active population in 1931 ([Kraljevina Jugoslavija 1940](#)).

¹⁴ SUZOR industrial categories (discussed above) do not exactly match the categories in the industrial census ([Ministarstvo trgovine i industrije 1941](#), pp. 25–30).

¹⁵ SUZOR published data on industrial workers insured by the institution while industrial census data were self-reported by industrial establishments. There was a lack of clarity in the survey question on employment in the industrial census. Establishments were to report the number of employees needed to operate uninterruptedly and under full production capacity. The assumed amount of working hours, however, was not specified. Establishments that assumed a working day of 8 hours would report a smaller number of employees than those that assumed a longer working day ([Ministarstvo trgovine i industrije 1941](#), p. 10).

Table 2. *Distribution of insured industrial workers across industries and regions (population weighted, 1932–1939 average)*

Region ^a	Yug	Slo	C-S	Voj	N.Ser.	B-H	Dal	S.Ser	Mne
Wood + Wood manufactures ^b	21.09	28.19	23.48	15.51	3.57	21.10	3.72	2.44	1.98
Textiles	17.64	44.83	19.79	16.79	8.43	2.23	3.36	4.28	0.29
Metals and machinery	13.77	29.43	13.32	17.59	16.40	6.91	7.57	3.23	5.55
Food and beverage	13.26	16.49	18.64	25.21	9.92	6.54	12.91	5.51	4.78
Stone and earth	9.48	26.53	15.13	21.13	8.17	5.90	17.03	2.14	3.97
Leather and rubber + Rubber manufactures ^b	8.37	33.55	20.51	15.33	12.17	6.23	5.98	4.40	1.83
Tobacco	5.68	9.80	2.90	8.53	7.27	14.75	15.45	17.12	24.18
Paper + Printing ^b	4.54	40.00	19.13	13.26	14.88	3.49	5.92	1.45	1.87
Chemicals	3.82	31.04	21.82	12.32	7.32	10.42	12.99	1.90	2.20
Electric power and water supply	2.36	14.27	22.24	19.01	15.75	6.19	15.19	3.53	3.81
Total industry	100	29.21	18.30	17.31	9.33	9.24	8.34	4.20	4.06
Population shares	100	8.21	21.77	10.21	23.83	16.68	4.9	12.79	1.61

Source: Own calculations based on SUZOR data (*Središnji ured za osiguranje radnika 1932–1941*) and 1931 population census results (*Kraljevina Jugoslavija 1937*).

Notes: ^aRegion abbreviations: Slo = Slovenia; C-S = Croatia-Slavonia; Voj = Vojvodina; N.Ser = North Serbia; B-H = Bosnia-Herzegovina; Dal = Dalmatia; S.Ser. = South Serbia; Mne = Montenegro. ^bThe plus sign (+) indicates which industries have been aggregated. The aggregation was done conditional on the data available for industrial intensities needed in order to perform our econometric analysis in Section 3.2.

employment which is shown in the penultimate row of table 2. The most industrial region was Slovenia accounting for almost 30 percent of total industrial activity in Yugoslavia. The North-West (Slovenia, Croatia-Slavonia, and Vojvodina) was the most industrial part of the country employing two-thirds of all industrial workers. The rest of industry was distributed across North Serbia, Bosnia-Herzegovina, Dalmatia, South Serbia, and Montenegro (in that order).

The ten industrial categories are ordered according to their share in total industrial employment reported in the second column of table 2. The wood industry was the largest industrial employer accounting for about a fifth of total industrial employment. The textile industry was in second place capturing approximately 18 percent. The top four industries accounted for two-thirds of total Yugoslav industrial activity. A third of industrial employment was distributed among the remaining six smaller industrial categories.

The regional distribution of each industry is shown in the first ten rows of table 2. More than half of each industry (except tobacco) was located in the North-West. In seven out of ten industrial categories Slovenia had the largest share, and in all cases (bar tobacco) the leader was from the North-West. Montenegro and South Serbia stand out with a relatively large share in the tobacco industry.

Krugman's specialization index (*Krugman 1991a*) provides a formal picture of regional specialization by comparing a region's industrial employment structure with the rest of the country's average. The index of spatial concentration provided by *Wolf (2007, pp. 30–31)* measures industrial concentration across space by comparing an industry's employment and area shares across regions.¹⁶ Both indices are defined in the range from zero to two.

¹⁶ Krugman's specialization index (*Krugman 1991a*) is often used in the literature (see e.g., *Crafts and Mulatu 2005, p. 507* or *Martinez-Galarraga 2012, p. 259*). Using the index of spatial concentration provided by *Wolf (2007, pp. 30–31)* allows direct comparisons of results for interwar Yugoslavia with those for interwar Poland.

Table 3. *Krugman's specialization index, Yugoslavia 1932–1939*

	Slo	C-S	Voj	N.Ser.	B-H	Dal	S.Ser.	Mne	Avg.
1932	0.30	0.29	0.33	0.45	0.50	0.39	0.76	1.10	0.52
1933	0.30	0.29	0.36	0.48	0.55	0.38	0.68	1.06	0.51
1934	0.32	0.24	0.34	0.51	0.50	0.37	0.70	0.84	0.48
1935	0.30	0.18	0.39	0.45	0.89	0.80	0.42	0.71	0.52
1936	0.32	0.23	0.37	0.42	0.84	0.81	0.64	0.69	0.54
1937	0.31	0.23	0.37	0.40	0.77	0.78	0.61	0.82	0.54
1938	0.33	0.26	0.39	0.36	0.77	0.83	0.88	0.90	0.59
1939	0.32	0.25	0.37	0.35	0.81	0.74	0.78	0.90	0.57

Source: Own calculations based on SUZOR data ([Središnji ured za osiguranje radnika 1932–1941](#)).

Notes: Region abbreviations as in table 2.

The specialization index will take the value of zero if a region's industrial employment structure is identical to the rest of Yugoslavia, and the value of two if a region's industrial employment structure has no resemblance to the rest of Yugoslavia. The industrial concentration index will take the value of zero if employment in a given industry is equally distributed across Yugoslavia, and the value of two if a given industry is completely concentrated in one of the regions.

Table 3 presents the values of the Krugman index for eight regions as well as the regional average for each sample year. On average, regional specialization increased during the sample period. As a rule smaller regions (e.g., South Serbia, Montenegro) were more specialized than larger regions (e.g., Croatia-Slavonia, North Serbia). This is expected as in smaller regions a dominant industry was discernible (e.g., tobacco in South Serbia and Montenegro), while larger regions had a broader industrial base. Bosnia-Herzegovina and Dalmatia became notably more specialized in the second half of the 1930s. Bosnia-Herzegovina increased its specialization in wood industry, while Dalmatia specialized in the stone and earth industry.

Table 4 provides the values of the spatial concentration index for ten industries as well as the industry average for each sample year. Most industries show a decrease in concentration, the exceptions being textiles, food and beverages, and paper and printing. The textile industry was among the most regionally concentrated industries throughout the period. On the other hand, the tobacco industry was among the least concentrated industries. The largest change was recorded by the chemical industry—at the start of the sample period it was the most concentrated industry while at the end it was the most dispersed one. The chemical industry was initially highly concentrated in the North-West (Croatia-Slavonia and Vojvodina) and over time it became more dispersed across Yugoslavia.

Results for Yugoslavia show several remarkable similarities with interwar Poland ([Wolf 2007](#), p. 30). In both countries regional specialization increased during the 1930s, albeit initially decreasing during the depression years (cf. Section 2.1). Textiles were among the most spatially concentrated industries in Yugoslavia as well as Poland. Overall, the level of both regional specialization and industrial concentration was lower in Yugoslavia than in Poland.

3. Explaining industrial location

3.1 Theoretical and empirical framework

Three different economic theories may help explain what determined the location of industrial activity within interwar Yugoslavia. The Neoclassical Heckscher-Ohlin theory

Table 4. *Wolf's index of spatial concentration, Yugoslavia 1932–1939*

	1932	1933	1934	1935	1936	1937	1938	1939
Wood + Wood manufactures	0.87	0.87	0.87	0.78	0.74	0.72	0.73	0.70
Textiles	0.82	0.85	0.82	0.93	0.95	0.93	0.92	0.91
Metals and machinery	0.73	0.71	0.69	0.63	0.61	0.58	0.59	0.62
Food and beverage	0.44	0.50	0.48	0.71	0.71	0.70	0.69	0.67
Stone and earth	0.72	0.72	0.77	0.75	0.72	0.72	0.69	0.66
Leather and rubber + Rubber manufactures	0.60	0.63	0.62	0.70	0.70	0.71	0.72	0.72
Tobacco	0.59	0.64	0.67	0.30	0.49	0.43	0.57	0.49
Paper + Printing	0.79	0.77	0.78	0.82	0.84	0.77	0.80	0.81
Chemicals	0.93	0.88	0.84	0.52	0.61	0.63	0.62	0.57
Electric power and water supply	0.67	0.64	0.65	0.62	0.65	0.63	0.62	0.60
Average	0.72	0.72	0.72	0.68	0.70	0.68	0.70	0.67

Source: Same as for table 3.

(Ohlin 1933) assumes zero transport costs, perfect competition, and non-increasing returns to scale. The theory predicts that comparative advantage in natural endowments and factors of production (including technological differences) determines the location of economic activity. New Economic Geography (Krugman 1991a) allows for the presence of transportation costs and intermediate goods, assumes monopolistic competition and increasing returns to scale. According to New Economic Geography theory industries will be inclined to locate closer to larger markets in order to minimize on transportation costs. Industry linkages with consumer and supplier markets (i.e., input–output relations) play a key role in determining industrial location (Krugman and Venables 1995; Venables 1996).

Crucially, there is no necessary connection between increasing returns and path dependence (David 2007, p. 102).¹⁷ New Economic Geography and Path Dependence can work through different channels: “[f]irst, there can be positive feedback effects due to market access as highlighted in new economic geography models in the wake of Krugman (1991a). Second, sunk costs can introduce another form of hysteresis in location choice that can delay relocation” (Crafts and Wolf 2014, p. 1110). In our framework increasing returns are part of New Economic Geography forces, while Path Dependence operates through sunk costs that prohibit a relocation of industry.¹⁸

The model of Midelfart-Knarvik *et al.* (2000, 2001) allows the quantification and comparison of the predictive power of Heckscher-Ohlin, New Economic Geography, and Path Dependence theories. The intuition behind the model is that regions have different characteristics, and industries vary in the intensity of use of those characteristics. The interplay between regional and industrial characteristics produces the main variables of interest that potentially explain the location of industry.

Table 5 summarizes the variation in regional characteristics across eight Yugoslav regions, showing average values for our sample period (1932–1939). The distribution of

¹⁷ David (1985) originally developed the concept of Path Dependence in a study of diffusion and adoption of technology. North (1990, p. 93) refers to this study as: “The article that first called the attention of economic historians to the issue of path dependence...”. Note that the introduction of David (1975) already had traces of Path Dependence theory set out.

¹⁸ David (1985, pp. 334–336) refers to sunk costs as quasi-irreversibility of investment. “Among the most readily recognizable irreversibilities are those associated with investment in durable assets, the cost of which are ‘sunk’[...]” (David 2007, p. 101).

Table 5. *Regional characteristics (1932–1939 average)*

	Region ^a		Slo	C-S	Voj	N.Ser.	B-H	Dal	S.Ser.	Mne	Yug avg
No.	Regional characteristic	Unit									
1.	Coal availability	dinar per 10 kg	4.48	4.24	4.34	2.63	2.94	3.91	3.13	3.33	3.62
2.	Wood availability	dinar per m ³	92.81	104.25	126.08	117.37	74.39	119.31	120.26	83.75	104.78
3.	Unskilled labor wages	dinar per day	33.60	25.81	22.53	22.84	19.28	29.82	16.05	22.96	24.11
4.	Literacy rates	% of population	95.10	76.02	82.71	48.86	34.27	62.07	32.26	52.02	60.41
5.	Central bank credit	% of Yug. total	14.60	18.84	11.92	32.63	4.03	3.22	2.88	11.88	12.5
6.	Approved patents	% of Yug. total	30.03	21.27	18.09	17.98	3.81	7.22	0.81	0.78	12.5
7.	Market potential	m. 1990 int. USD	2347	2270	1879	1816	1717	1968	1441	1640	1776
8.	Inherited industry ratio	% of factories ^b	118.12	82.76	121.68	64.68	119.69	76.56	27.25	79.04	86.22

Source: See Appendix A.

Notes: ^aRegion abbreviations as in table 2. ^b(No. of factories established pre-1918 in region *i*/No. of factories established during interwar in region *i*) × 100.

coal and wood—the two dominant energy sources used by Yugoslav industry (Demokratska Federativna Jugoslavija 1945)—are captured by factor price data.¹⁹ Yugoslavia was characterized by low inter-regional labor mobility. As much as 94 percent of people born on Yugoslav territories were living in their region of birth during the interwar (Kirk 1946, p. 143). Regional comparative advantage in unskilled labor and human capital are proxied using data on wages and literacy rates.²⁰ Belgrade and Zagreb were two main financial centers in interwar Yugoslavia (Lampe and Jackson 1982). The regional distribution of central bank credit controls for financial capital immobility. The importance of technological innovation is measured by patent statistics. Market potential estimates capture regional differences in access to supplier and consumer markets. Finally, the inherited industry ratio measures the regional variation in the ratio of factories created before and after the establishment of Yugoslavia.

The highly industrial North-West (Slovenia, Croatia-Slavonia, and Vojvodina) had a comparative advantage in the relative availability of human capital and innovative activity. The three North-Western regions had the highest literacy rates and accounted for 70 percent of innovative activity. On the other hand, the Central-Eastern regions (Bosnia-Herzegovina, North Serbia, and South Serbia) had a comparative advantage in energy sources, unskilled labor and central bank credit. North Serbia alone received a third of all central bank credit and had the cheapest coal. Wood was the most abundant in Bosnia-Herzegovina. Unskilled labor wages in South Serbia were only a half of those in Slovenia and the lowest in Yugoslavia.

Economic Geography was more favorable in the North-West—Slovenia and Croatia-Slavonia had the highest market potential in Yugoslavia. North-Western regions had the advantage over other Yugoslav regions as they were closer to Yugoslav main foreign trading partners (Austria, Italy, Germany and Czechoslovakia). Coastal regions (Croatia-Slavonia, Dalmatia and Montenegro) profited from direct sea access (and proximity to Italy) more than inland regions.

Out of all the factories listed in the 1938 industrial census 45 percent were established before Yugoslavia came together. History favored the three North-West regions which accounted for almost three quarters of total inherited factories (Ministarstvo trgovine i industrije 1941). The inherited industry ratio shows that the majority of industry in Slovenia, Vojvodina, and Bosnia-Herzegovina was established before the creation of Yugoslavia. Other regions established more factories during the interwar than before becoming part of Yugoslavia.

Table 6 reports the variation in industrial intensities across ten industrial categories.²¹ The stone and earth industry was the most energy intensive industry. The use of coal energy prevailed over wood energy in all industries except the wood industry. In turn, the wood industry had the largest use for unskilled labor, while the most skilled labor intensive industry was paper and printing. Taken at the Yugoslav industry average, skilled labor

¹⁹ Following (Klein and Crafts 2012, p. 780) regional factor prices are used as regionally disaggregated production data are not available. The application of electricity for industrial purposes was limited. Yugoslav industry had little use for first nature (Krugman 1993) endowments such as water power (Kukoleča 1941, p. 354).

²⁰ Sectoral labor share measures are potentially endogenous to the location of industrial employment. Wages of daily laborers capture the relative availability of the immobile, low skilled, agricultural workforce. Human capital cannot be measured by the attained level of schooling as such data are not available on the necessary regional basis.

²¹ As common in the literature, industrial intensities are assumed to be time-invariant.

Table 6. *Industrial intensities*

Industry ^a			Wood	Tex	MM	FB	SE	LR	Tob	PP	Chem	EW	Ind avg
No.	Intensity	Unit											
1.	Coal	din per 1000 din output	0.83	10.16	27.46	17.73	101.38	6.15	33.71	16.10	16.59	16.05	24.61
2.	Wood	din per 1000 din output	11.42	1.25	1.50	10.01	27.20	1.61	9.50	1.75	3.59	1.75	6.96
3.	Unskilled labor	din per 1000 din output	177.85	104.73	49.32	26.06	158.29	41.06	15.57	169.64	65.63	33.65	84.18
4.	Skilled labor	din per 1000 din output	112.53	89.72	116.21	40.74	102.97	86.65	9.19	288.80	80.37	89.91	101.71
5.	Capital	din per din output	1.19	0.52	0.63	0.72	2.21	0.56	0.07	1.01	1.06	0.97	0.90
6.	Patent	% of industry total	2.40	3.19	48.97	2.93	7.88	2.56	0.12	4.05	4.47	23.43	10.00
7.	Sales to ind.	% of sales to industry	47.65	32.85	42.27	21.02	39.27	36.70	39.82	54.61	47.87	65.49	42.76
8.	Inputs from ind.	% of inputs from ind.	15.11	36.90	56.02	31.78	42.19	34.72	25.53	46.43	60.45	25.70	37.48

Source: See Appendix A.

Notes: ^aIndustry abbreviations: Wood = Wood + Wood manufactures; Tex = Textiles; MM = Metals and machinery; FB = Food and beverage; SE = Stone and earth; LR = Leather and rubber + Rubber manufactures; Tob = Tobacco; PP = Paper + Printing; Chem = Chemicals; EW = Electric power and water supply; Ind avg = industry average.

Table 7. *Heckscher-Ohlin, New Economic Geography, and Path Dependence captured through interaction terms of regional characteristics and industrial intensities*

Theory	No.	Interaction	Regional characteristic	Industrial intensity
I Heckscher-Ohlin	1.	Coal energy	= Coal availability	* Coal intensity
	2.	Wood energy	= Wood availability	* Wood intensity
	3.	Unskilled labor	= Unskilled labor wages	* Unskilled labor intensity
	4.	Human capital	= Literacy rates	* Skilled labor intensity
	5.	Financial capital	= Central bank credit	* Capital intensity
	6.	Innovation	= Approved patents	* Patent intensity
II New Economic Geography	7.	Sale linkages	= Market potential	* Sales to industry
	8.	Input linkages	= Market potential	* Inputs from industry
III Path Dependence	9.	Path dependence	= Inherited industry ratio	* Capital intensity

inputs were more costly than unskilled labor inputs, while total labor inputs (unskilled and skilled) were almost six times more expensive than energy inputs (coal and wood). The tobacco industry was the least capital and patent intensive. The most capital intensive industry was stone and earth, while the largest share of approved patents were specific to the metals and machinery industry. Electric power and water supply was the industry most strongly linked by sales to other industries, while food and beverages sold the least to other industries. The chemical industry had the biggest use for industrial intermediates, while the wood industry consumed the least intermediate inputs.

Table 7 shows how Heckscher-Ohlin, New Economic Geography, and Path Dependence theories are captured through the interactions of regional characteristics and industrial intensities.²² Heckscher-Ohlin predictions are captured by the first six interactions. The two energy interactions are expected to be negatively related to industrial location—industries with a high use of coal and wood energy will be attracted to regions where these energy sources are cheap. Unskilled labor interaction is also expected to be negatively related to industrial location—regions with low labor costs will be attractive to industries intensively using unskilled labor. The human capital interaction is expected to be positively related to industrial location—regions with the highest literacy rates will attract industries intensively using skilled labor. Capital and patent intensive industries will be attracted to regions with a high relative share of central bank credit and patent announcements, hence a positive sign is expected in both cases.²³ New Economic Geography forces are captured by interacting market potential with either sales or input linkages. Both interactions are expected to have a positive sign as industries with stronger ties to industrial consumers or suppliers will tend to locate closer to larger markets.²⁴ Path Dependence is controlled for by interacting the inherited industry ratio with capital intensity. A positive sign is expected as capital intensive industries with high sunk costs will tend to be located in regions with a high share of inherited industry.

²² See Appendix A for calculation methods and sources used for regional characteristics and industrial intensities.

²³ No data are available on agricultural inputs in order to construct an interaction capturing HO effects through land abundance as in [Crafts and Mulatu \(2005, 2006\)](#) or [Klein and Crafts \(2012\)](#).

²⁴ Insufficient data are available on size of establishments by industry to capture the interaction between economies of scale and market potential suggested by [Krugman \(1991a\)](#).

3.2 *Econometric analysis*

The baseline econometric equation to be estimated can be written as:

$$\ln LOCATION_{ik,t} = \alpha + \beta_n INTERACTION_{ik,t} + \gamma_m \ln REGION_{i,t} + \delta_m INDUSTRY_k + \varepsilon_{ik,t} \quad (1)$$

where $LOCATION_{ik,t}$ is the population weighted share of region i ($i = 8$) in the total industrial employment of industry k ($k = 10$) at time t ($t = 8$); $REGION_{i,t}$ is a set of m ($m = 8$) regional characteristics varying over regions and time; $INDUSTRY_k$ is a set of m industrial intensities varying over industries only; $INTERACTION_{ik,t}$ is a set of n ($n = 9$) interaction variables varying over regions, industries, and time; α is a constant term and $\varepsilon_{ik,t}$ an error term.²⁵

Baseline econometric results are summarized in table 8. Model 1 shows the baseline regression estimated using pooled ordinary least squares (POLS) with cluster robust standard errors on the regional dimension. Model 2 differs from the baseline regression only in that it calculates cluster robust standard errors using a correction for a small number of clusters (i.e., few-cluster robust standard errors). Model 3 is a spatial error model (SEM) estimated using maximum likelihood which aims to capture the possibility of spatial correlation in the error term. All three models include region, industry and time fixed effects.

The bottom part of table 8 provides information on the inclusion of fixed effects, the number of observations and the share of explained variation (R^2). To account for potential omitted variables and measurement issues, region and industry fixed effects substitute for regional and industrial characteristics (see Wolf 2007, p. 36; Klein and Crafts 2012, p. 786). Time fixed effects are included to capture any time-variant shock affecting all regions and all industries equally. Cross-sectional data are pooled over time which results in 640 observations.²⁶ The middle portion of the table reports the estimated coefficients on the interaction variables—the primary regressors of interest.²⁷

Model 1 explains 60.9% of the variation in the location of industry in interwar Yugoslavia. Three interaction variables stand out. Human capital, input linkages, and path dependence are highly statistically significant and estimated with the expected positive sign. Thus Heckscher-Ohlin, New Economic Geography, and Path Dependence theories each have one statistically significant representative.²⁸

Estimating model 1 with cluster robust standard errors may still lead to standard errors being downward biased if the number of clusters is small. In model 2 few-cluster robust standard errors are calculated using the wild-cluster bootstrap method (Cameron and Miller 2015, pp. 27–28).²⁹ While using the correction for few-clusters leads to the estimated

²⁵ The specification is based on Midelfart-Knarvik *et al.* (2001) and natural logarithms are taken accordingly.

²⁶ Performing a Chow F -test on the coefficients in two sub-samples (1932–1935 and 1936–1939) does not reject the null hypothesis of the same coefficients over time.

²⁷ Full regression output is available from the author upon request.

²⁸ Estimating the baseline model with an aggregate measure of labor abundance (interacting total active population per land with labor intensity) instead of unskilled labor and human capital does not qualitatively change the results—the coefficients on input linkages and path dependence are of the same order of magnitude and significant at the one percent level, while labor is also significant at the one percent level as would be expected (results are available from the author upon request). Separating the aggregate labor measure (as in table 8) has the advantage of informing us that human capital mattered rather than unskilled labor.

²⁹ Bootstrapping is appealing in the case of small samples as it does not rest on asymptotic formulas for inference, but on re-sampling from own data. In the procedure 400 re-samples are used as suggested by Cameron and Miller (2015, p. 12).

Table 8. *Modeling Yugoslav industrial location, 1932–1939*

	(1)	(2)	(3)
	POLS	POLS	SEM
I Heckscher-Ohlin			
Coal energy	−0.0038 (0.361)	−0.0038 (0.455)	−0.0039 (0.218)
Wood energy	−0.0036 (0.886)	−0.0036 (0.905)	0.0015 (0.914)
Unskilled labor	0.0020 (0.488)	0.0020 (0.420)	0.0016 (0.295)
Human capital	0.0055*** (0.000)	0.0055*** (0.000)	0.0056*** (0.000)
Innovation	0.0004 (0.814)	0.0004 (0.790)	0.0011 (0.428)
Financial capital	−0.0210 (0.783)	−0.0210 (0.695)	−0.0161 (0.767)
II New Economic Geography			
Sales linkages	0.3339 (0.877)	0.3339 (0.880)	0.6033 (0.605)
Input linkages	3.5141*** (0.004)	3.5141*** (0.005)	3.5707*** (0.000)
III Path Dependence			
Path dependence	0.3832*** (0.000)	0.3832*** (0.000)	0.3953*** (0.000)
Region, industry and time FE	Yes	Yes	Yes
Observations	640	640	640
R ²	0.609	0.609	0.601

Notes: ***Statistical significance at the one percent level. *p*-values in parentheses. In model 3, the *p*-value of the spatial interaction term λ is 0.573.

standard errors from model 2 to be in general higher than those from model 1 the same interactions as in model 1 remain highly statistically significant.

Standard errors for individual observations across regions may be correlated. Failing to account for spatial correlation of the error term would lead to standard errors of the regressors being biased downwards. The cross-sectional dependence test of [Pesaran \(2004\)](#) on the residuals from model 1 fails to reject the null hypothesis of cross-sectional independence suggesting that spatial correlation is not present. As an additional test for spatial correlation model 3 includes a spatial interaction term (conventionally labeled lambda) constructed by applying a spatial weight matrix to the error term ([Elhorst 2014](#)). The spatial weight matrix (W) is a n times n positive symmetric matrix with element $w_{i,j}$ at location i, j for n regional capitals ($n = 8$), and with $w_{i,i} = 0$ for the diagonal elements. The spatial weights are distance based so that $w_{i,j} = 1/d_{i,j}$ where $d_{i,j}$ represents the shortest distance (via rail or sea, in kilometers) between i and j .³⁰ A distance based spatial weight matrix is preferred to a contiguity based one because of the uneven geography of Yugoslavia which would not be adequately captured with a binary measure.³¹ The spatial weight matrix is row-standardized

³⁰ For details on the calculation of distances see Appendix B.

³¹ The results remain qualitatively unchanged when using a contiguity (binary) spatial weight matrix where regions with a shared (land or sea) border take the value of 1.

meaning that each row sums to one (Arbia 2006, pp. 37–39). Based on the LM Error test (Burridge 1980) the null hypothesis of spatial independence of the error term cannot be rejected for model 3. Accordingly, the lambda parameter is estimated as statistically insignificant (with a p -value of 0.573) thus making the spatial modeling of the error term redundant. The parameters on the interaction terms estimated as statistically significant in models 1 and 2 remain qualitatively unchanged in model 3.

Industrial location may be endogenous to market potential. Two stage least squares (2SLS) instrumental variable estimation is used to empirically disentangle the possible endogeneity. The results are summarized in table 9. Model 1 estimates the baseline regression using 2SLS instrumental variable estimation. Model 2 differs from model 1 only in that it decomposes market potential into its foreign and domestic component and instruments for the domestic part.³² Following Head and Mayer (2004) instrumental variables based on the distance to main economic centers are used.³³

In model 1 market potential of a region is instrumented with the inverse distance between a regional capital and Berlin (the capital of Yugoslavia's largest trading partner). Results of instrumental variable under-identification (Sanderson and Windmeijer 2016) and weak-identification (Stock and Yogo 2005) tests are reported in the bottom part of table 9. Based on the relevant test statistic the null hypotheses of unidentified and weak instruments are both rejected. The middle portion of the table reports the estimated coefficients on the interaction variables of interest while partialling out all previously insignificant regressors.³⁴ The results are firmly in line with the results obtained by pooled OLS estimation. All three theories play a role in driving industrial location. The same regressors are statistically significant and estimated with the expected positive sign.

It can be argued that the endogeneity of (total) market potential comes through its domestic component.³⁵ In order to test for this possibility model 2 instruments for domestic market potential of region i using the sum of inverse distances between the capital of region i and three main domestic economic centers (Belgrade, Ljubljana, and Zagreb). Results of instrumental variable under-identification (Sanderson and Windmeijer 2016) and weak-identification (Stock and Yogo 2005) tests reject the null hypotheses of unidentified and weak instruments. Once again all three of the tested theories are shown to have explanatory power. Coefficients on the human capital and path dependence interactions remain highly statistically significant and are estimated with the expected sign. The exercise in model 2 reconfirms the findings from model 1 that New Economic Geography influenced industrial location only through input linkages (sales linkages were not significant) and informs us that both foreign and domestic input linkages were significant.

³² In both models 1 and 2, the equation to be estimated is exactly identified (i.e., there is an equal number of endogenous regressors and instrumental variables) in which case the standard IV estimator is identical to the GMM estimator (Baum *et al.* 2003, p. 5).

³³ An anonymous referee deserves credit for suggesting this approach. Instrumental variables suggested by Head and Mayer (2006, p. 589) are weakly identified in our case.

³⁴ Partialling is used to obtain a covariance matrix of orthogonality conditions which is of full rank in the case when cluster robust standard errors are used and the number of clusters is smaller than the number of regressors (including instrumental variables) (Baum *et al.* 2007, pp. 18–19). According to the Frisch-Waugh-Lovell (FWL) theorem, the coefficients on the resulting regressors are the same as those that would be obtained if all the regressors were included (Davidson and MacKinnon 2004, pp. 64–77).

³⁵ Martinez-Galarraga (2012, p. 266) notes: "A location with good access to markets will attract industrial activities and this, in turn, will increase the market potential of this location (through the domestic component of the market potential equation)."

Table 9. *Two stage least squares instrumental variable estimation of Yugoslav industrial location, 1932–1939*

	(1)	(2)
	2SLS	2SLS
I Heckscher-Ohlin		
Human capital	0.0057*** (0.000)	0.0047*** (0.001)
II New Economic Geography		
Sales linkages	−1.5870 (0.520)	
Foreign sales linkages		0.4508 (0.899)
Domestic sales linkages		0.5905 (0.511)
Input linkages	4.9136*** (0.000)	
Foreign input linkages		4.1744** (0.025)
Domestic input linkages		3.7177** (0.038)
III Path Dependence		
Path dependence	0.3852*** (0.000)	0.4334*** (0.000)
Region, industry, time FE	Yes	Yes
Observations	640	640
SW [$\chi^2(1)$] Wald statistic		
Sales linkages	60.07***	
Input linkages	60.53***	
Domestic sales linkages		36.50***
Domestic input linkages		38.19***
Cragg-Donald F-statistic	237.27	400.90
Endogeneity C test [$\chi^2(2)$]	0.176	0.578
Centered R^2	0.089	0.124

Notes: ** and *** statistical significance levels of 5 and 1 percent, respectively. *p*-values in parentheses.

Standardized beta coefficients are used to ascertain the relative economic significance of statistically significant regressors. Table 10 shows standardized beta coefficients of statistically significant interaction variables from the baseline pooled OLS and 2SLS estimations. The relative shares of standardized coefficients are given in parentheses. Results clearly show that while all three of the tested theories mattered, New Economic Geography forces were the dominant drivers of Yugoslav industrial location. In all three models New Economic Geography forces accounted for more than half of the explained variation in industrial location. The last column shows that foreign input linkages mattered more than domestic ones.

3.3 Discussion of econometric results

New Economic Geography effects are identified through the interplay of market potential and input linkages. Regions with high market potential (e.g., Slovenia, Croatia-Slavonia)

Table 10. *Standardized beta coefficients of statistically significant interaction variables*

	Table 8, model 1	Table 9, model 1	Table 9, model 2
I Heckscher-Ohlin			
Human Capital	1.625*** (26.3%)	1.674*** (21.8%)	1.369*** (21.1%)
II New Economic Geography			
Input linkages	3.617*** (58.5%)	5.057*** (65.9%)	
Foreign input linkages			2.533** (39%)
Domestic input linkages			1.526** (23.5%)
III Path Dependence			
Path dependence	0.943*** (15.2%)	0.948*** (12.3%)	1.067*** (16.4%)

Notes: ** and *** statistical significance levels of 5 and 1 percent, respectively. Relative shares in parentheses.

providing easier access to supplier markets exhibited a pull on industries with a high use of intermediates in the production process (e.g., chemicals, metals and machinery). Industrial demand for intermediate goods could not be met with domestic supply only. Foreign-produced intermediates played a relevant role in the production process of Yugoslav industry. This interpretation is easily squared with the high share that manufactures represented in total Yugoslav imports.³⁶ Neither domestic nor foreign sales linkages determined the location of industry. Sales of industrial intermediates on domestic markets were not large enough to matter as domestic market potential was at least ten times smaller than foreign market potential in each region. The share of manufactures in Yugoslav exports was low and domestic industry was for the most part unable to place intermediate industrial goods on foreign markets.³⁷

The key comparative advantage driving industrial location was human capital. Skill intensive industries (e.g., paper and printing, metals and machinery) were attracted to regions with a highly literate workforce (e.g., Slovenia, Croatia-Slavonia, and Vojvodina) able to serve such industries. Regions where illiteracy dominated (e.g., South Serbia or Bosnia-Herzegovina) did not attract skill intensive industries. The size of the skilled industrial workforce was economically significant as a third of employed workers in industry were skilled workers (*Ministarstvo trgovine i industrije 1941*). Demand for skilled workers was high and rising during the 1930s—wages of skilled workers were on average double the size of wages received by unskilled labor, and rose to a factor of 2.4 by 1939.³⁸

Part of industrial location was determined by Path Dependence. Capital intensive industries (e.g., stone and earth) were mainly located in regions where pre-1918 factories were more numerous (e.g., Vojvodina and Slovenia). The relocation of capital intensive industries was prohibited by high sunk costs in buildings and equipment. In contrast, industries also dating to the nineteenth century but facing low sunk costs (e.g., tobacco industry) predominantly located outside of the North-West.

³⁶ The 1935–1937 average of imported manufactures was 74.8% of total imports (*Drabek 1986*, p. 474).

³⁷ The 1935–1937 average of exported manufactures was only 16.8% of total exports (*Drabek 1986*, p. 474). Little change in the composition of Yugoslav trade is seen during the 1930s.

³⁸ Estimates are based on the nominal wages in the wood industry (*Radnička komora za Hrvatsku i Slavoniju 1929–1941*)—the largest industrial employer in Yugoslavia.

Table 11. *Determinants of industrial location during the interwar period (ca. 1920–1939)*

Country	Source	Time frame	Mechanism ^a	Theory ^b	Stand. β coeff. relative shares ^c
Britain	Crafts and Mulatu (2005, table 6)	1921, 1931	Human capital	HO	N/A
			Coal energy	HO	N/A
Poland	Wolf (2007, table 8)	1926–1934	Human capital	HO	48%
			Innovation	HO	15%
			Input linkages	NEG	38%
Spain	Martnez-Galarraga (2012, table 7)	1929	Agriculture	HO	45%
			Scale effects	NEG	55%
USA	Klein and Crafts (2012, table 13)	1920	Input linkages	NEG	45%
			Sales linkages	NEG	16%
			Scale effects	NEG	39%
Yugoslavia	Present paper [table 10]	1932–1939	Human capital	HO	26%
			Input linkages	NEG	58%
			Path Dependence	PD	15%

Source: Own calculations based on sources provided in column 2.

Notes: ^aMechanisms at work are labeled in accordance with usage in present paper. See individual country papers for details. ^bHO, Heckscher-Ohlin; NEG, New Economic Geography; PD, Path Dependence. ^cOnly standardized beta coefficients of statistically significant interactions are included in the calculation of the relative shares.

Table 11 summarizes the determinants of industrial location during the interwar period, across five countries—Britain, Poland, Spain, the USA, and Yugoslavia. The table reports the mechanism at work (column four), the theory the mechanism represents (column five), and the relative shares of standardized beta coefficients of statistically significant interaction variables (column six).³⁹ The values reported in column six are own calculations based on beta coefficients reported in individual country papers cited in column two.

In interwar Poland, Spain, and Yugoslavia both Heckscher-Ohlin and New Economic Geography forces determined the location of industry simultaneously. The Anglo-American interwar experience stands out as Heckscher-Ohlin (Britain) or New Economic Geography (USA) can fully account for the location of industry. In Spain the effect of New Economic Geography dominated (55%) while in Poland it was Heckscher-Ohlin forces that captured the largest relative share (63%). In Yugoslavia New Economic Geography effects were the strongest, followed by Heckscher-Ohlin, and Path Dependence. Yugoslavia compares most favorably to Poland as both human capital and input linkage effects determined the location of industry in these two countries (table 11).

The resemblance of industrial location determinants in Poland and Yugoslavia can perhaps be attributed to the similarly low levels of industrialization in both countries.⁴⁰ The importance of human capital in both countries may be the outcome of pronounced regional

³⁹ The labeling of the mechanisms at work is in accordance with the ones used in the present paper. See individual papers (cited in column 2 of table 11) for details.

⁴⁰ The percentage of working population employed in industry was 17% for Poland and 11% for Yugoslavia in 1931 (Teichova 1985, p. 228, Table 5.2).

differences in literate population—legacy of the nineteenth century partition of Poland, and the unification of heterogeneous regions in the case of Yugoslavia. The difference between Spain and Yugoslavia is in accordance with the finding of [Martnez-Galarraga \(2012, p. 273\)](#) who concluded that “although Poland and Spain were economies of a similar size on the periphery of Europe the driving forces of industrial location in the two countries were different”.

The key difference between the Polish and Yugoslav industrial location determinants is that the mechanism of innovative activity has some explanatory power only in the case of Poland. The insignificance of industry-specific innovative activity in Yugoslavia is in line with ([Teichova 1985, p. 253](#)): “Most branches of industry in central-east and south-east European countries had been developed on the basis of imported machinery; domestic production of technologically more advanced equipment was able to meet only a small fraction of demand on the respective home markets”. The implication of the opposing result for Poland is that this country may be seen as an exception in Eastern Europe if it was able to serve domestic demand for machinery.

4. Conclusion

What determines the location of industry within a country? Theoretical predictions of three theories—Heckscher-Ohlin, New Economic Geography, and Path Dependence—were quantified and compared using panel data econometrics and a novel dataset on interwar Yugoslavia. Results show that all three theories mattered and that New Economic Geography forces played a dominant role. New Economic Geography worked through the interplay of market potential and input linkages. Comparative advantage operated through the relative availability of human capital. Path Dependence arose as sunk costs in capital exceeded the benefits of relocation.

The results reinforce the consensus view in the literature that several theories can simultaneously explain the distribution of industrial activity. Put in an international perspective, both Heckscher-Ohlin and New Economic Geography forces determined industrial location in three peripheral interwar economies—Poland, Spain, and Yugoslavia. On the other hand, the Anglo-American interwar experience stands out as either Heckscher-Ohlin (Britain) or New Economic Geography (USA) can fully account for the location of industry within these countries.

The results provide empirical evidence on the effect of sunk costs on industrial location, which is in line with the recent findings of [Crafts and Wolf \(2014\)](#). The main novelty is that Path Dependence can affect the location of industry in addition to Heckscher-Ohlin and New Economic Geography forces. Therefore, an interesting avenue for future research could be to establish just how far-reaching are the effects of Path Dependence on the present day location of industrial activity.

Acknowledgements

Earlier versions of this paper were presented at the Fresh Workshop in Warsaw, WRDTC Economics Conference at the University of Sheffield, CHERRY and Economics Workshops at the University of York, 3rd Joint PhD Symposium on SEE at UCL, LSE EH590 Thesis Workshop, Belgrade WEast Workshop, EHES Summer School on Eastern Europe at Humboldt University, 9th SEEMHN Conference in Sofia, EHS’ RTC in Manchester, EHES Beyond GDP Summer School at the

University of Groningen and EHS Annual Conference at Royall Holloway University. I am grateful to all the participants for their thought provoking discussions and comments. In particular, I thank Alejandra Irigoin, Anna Missiaia, Thilo Albers, Ben Gales, Luke Kirwan, Martin Uebele, Tamas Vonyo, Bert Kramer and Joost Venstra. I owe a special thanks to Matthias Morys for his invaluable feedback on previous versions of the paper. The PhD Studentship from the Department of Economics and Related Studies, University of York and the Bursary for PhD students from the Economic History Society are gratefully acknowledged. The usual disclaimer applies.

Conflict of interest statement. None declared.

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Appendix A. Data appendix

Dependent variable:

The Location of Industry

Definition: Share of region i in total industrial employment of industry k , weighted by population share of region i .

Sources: [Središnji ured za osiguranje radnika \(1932–1941\)](#) and [Kraljevina Jugoslavija \(1940\)](#).

Regional Characteristics:

1. Coal availability

Definition: Nominal price in dinar for 10 kg of coal (brown and lignite) in city c , taken to proxy prices in region i .

Notes: Some missing prices linearly interpolated. Prices for Montenegro proxied by average of adjacent regions. If more than one city c in region i , then an arithmetic average of prices in c was taken.

Sources: Various issues of [Kraljevina Jugoslavija \(1932–1941\)](#).

2. Wood availability

Definition: Nominal price in dinar for one m³ of firewood in city c , taken to proxy prices in region i .

Notes: If more than one city c in region i , then an arithmetic average of prices in c was taken.

Sources: Various issues of [Kraljevina Jugoslavija \(1932–1941\)](#).

3. Unskilled labor wages

Definition: Nominal daily laborer's wage in dinar in city c , taken to proxy unskilled labor wages in region i .

Notes: If more than one city c in region i , then an arithmetic average of wages in cities c was taken.

Sources: Various issues of [Kraljevina Jugoslavija \(1932–1941\)](#).

4. Literacy rates

Definition: Share of total literate population in region i , in total population of region i .

Notes: Data aggregated to historical regions from municipal level data. Data for sample period linearly interpolated by census data for 1931 and 1948. Data from 1948 corrected for post Second World War territorial changes.

Sources: ([Kraljevina Jugoslavija 1938](#)) and ([FNR Jugoslavija 1955](#)).

5. Central Bank credit

Definition: Share of central bank credit (bills of exchange + mortgage loans) allocated to regional offices in region i (weighted by regional population shares), in total central bank credit allocated to all its regional offices.

Notes: If a region had more than one office the sum of credit allocated to these offices was taken.

Sources: [Narodna Banka Kraljevine Jugoslavije \(1935\)](#) (for 1932) and [Narodna Banka Kraljevine Jugoslavije \(1933–1939\)](#) (for 1933–1939).

6. Approved patents

Definition: Share of approved patents in region i (weighted by regional population shares), in total number of approved patents.

Sources: [Uprava za zaštitu industrijske svojine \(1921–1941\)](#) and [Kraljevina Jugoslavija \(1937\)](#).

7. Market potential

Definition and Sources: See Appendix B.

8. Inherited industry ratio

Definition: Total number of factories established pre-1918 in region i /total number of factories established during interwar in region i , by year t .

Sources: [Ministarstvo trgovine i industrije \(1941\)](#).

Industrial Intensities:

1. Coal intensity

Definition: Industry k use of domestically produced coal (brown and lignite) in dinar / industry k gross value of output in 1000 dinar.

Notes: Coal intensity for tobacco industry proxied by industry average.

Sources: [Ministarstvo trgovine i industrije \(1941\)](#), [Demokratska Federativna Jugoslavija \(1945\)](#).

2. Wood intensity

Definition: Industry k use of wood / industry k gross value of output in 1000 dinar.

Notes: Wood intensity for tobacco industry proxied by industry average.

Sources: [Ministarstvo trgovine i industrije \(1941\)](#), [Demokratska Federativna Jugoslavija \(1945\)](#).

3. Unskilled labor intensity

Definition: Industry k unskilled labor costs in dinar (employed workers times wages) / industry k gross value of output in 1000 dinar.

Notes: To get at unskilled wages per industry k , we applied unskilled labor wage weights based on the wood industry, to wages of industry k .

Sources: [Ministarstvo trgovine i industrije \(1941\)](#) and [Radnička komora za Hrvatsku i Slavoniju \(1929–1941\)](#).

4. Skilled labor intensity

Definition: Industry k skilled labor costs in dinar (employed workers times wages)/ industry k gross value of output in 1000 dinar.

Note: To get at unskilled wages per industry k , we applied skilled labor wage weights based on the wood industry, to wages of industry k .

Sources: [Ministarstvo trgovine i industrije \(1941\)](#) and [Radnička komora za Hrvatsku i Slavoniju \(1929–1941\)](#).

5. Capital intensity

Definition: Industry k capital stock value in dinar / total industry capital stock value in dinar.

Sources: [Ministarstvo trgovine i industrije \(1941\)](#).

6. Patent intensity

Definition: Share of approved patents specific to industry k (1932–1938 average) in total number of industry patents (1932–1938).

Sources: ([Uprava za zaštitu industrijske svojine 1921–1941](#)).

7. Sales to industry

Definition: Share of industry k sales to domestic and foreign industry (i.e., including exports) in total available resources of industry k .

Notes: The first input–output table available for the Yugoslav economy (constructed for the year 1955) was used.

Sources: [Petrović \(1957\)](#).

8. Inputs from industry

Definition: Share of industry k use of domestic and foreign intermediates (i.e., including imports) in total available resources of industry k .

Notes: The first input–output table available for the Yugoslav economy (constructed for the year 1955) was used.

Sources: [Petrović \(1957\)](#).

Instrumental Variables:

Definition: Foreign instrument—inverse railway distance (in kilometers) between the capital of region i and Berlin (capital of Yugoslavia's main foreign trading partner) at time t . Domestic instrument—sum of inverse railway distances (in kilometers) between the capital of region i and main domestic economic centers (Belgrade, Ljubljana, and Zagreb, respectively) at time t .

Sources: See Appendix B.

Table A1. *Summary statistics*

Variable	Mean	SD	Min.	Max.
<i>Dependent variable</i>				
Location of industry	2.14	0.97	0	3.85
<i>Interaction variables</i>				
Coal energy	30.96	35.35	0.57	177.37
Wood energy	32.2	35.98	4.92	138.8
Unskilled labor	265.07	191.14	40.69	644.39
Human capital	410.08	285.15	30.29	1317.58
Innovation	19.65	35.87	0	173.8
Financial capital	1.98	1.48	0.09	8.02
Sales linkages	3.22	0.87	1.5	5.16
Foreign sales linkages	0.74	0.58	0	2.2
Foreign input linkages	0.59	0.59	0	1.89
Input linkages	2.82	1	1.07	4.76
Domestic sales linkages	1.52	0.71	0.51	3.44
Domestic input linkages	1.37	0.4	0.51	2.06
Path dependence	3.93	2.39	0.29	11.06
Labor	5.98	4.58	0.28	20.97
<i>Region controls</i>				
ln Coal availability	1.26	0.25	0.71	1.75
ln Wood availability	4.63	0.23	4.1	5.10
ln Unskilled labor wages	3.15	0.26	2.61	3.62
ln Literacy rates	4.03	0.38	3.29	4.56
ln Approved patents	1.96	1.26	0	3.55
ln CB credit	2.2	0.85	0.9	3.64
ln Market potential	7.52	0.19	7.13	7.93
ln Market potential	7.46	0.18	7.08	7.86
ln Domestic market potential	4.64	0.49	3.66	5.29
ln Inherited industry ratio	4.36	0.48	2.9	5.03
<i>Industry controls</i>				
Coal intensity	24.61	27.16	0.8	101.4
Wood intensity	6.96	7.76	1.2	27.2
Unskilled labor intensity	84.18	60.09	15.6	177.9
Skilled labor intensity	101.7	69.75	9.20	288.8
Patent intensity	10.01	14.42	0.1	49
Capital intensity	0.9	0.54	0.1	2.2
Sales to industry	0.43	0.12	0.21	0.65
Sales to foreign industry	0.1	0.08	0	0.28
Sales to domestic industry	0.33	0.15	0.14	0.65
Inputs from industry	0.38	0.13	0.15	0.6
Inputs from foreign industry	0.08	0.08	0	0.24
Inputs from domestic industry	0.3	0.08	0.14	0.39
<i>Instrumental variables</i>				
Foreign instrument	0.0007	0.0001	0.0005	0.001
Domestic instrument	0.0165	0.0127	0.0036	0.0348
N	640			

Appendix B. Market potential calculation

The procedure used for market potential estimation is most similar to the one employed by [Martinez-Galarraga \(2012, 2014\)](#). According to the basic market potential equation market potential of region i , MP_i , can be expressed as:

$$MP_i = \sum_j Y_j / D_{ij} \quad (B1)$$

where Y_j is the measure of economic size of region j (usually GDP) and D_{ij} is the distance between regions i and j . Market potential can be split into its domestic and foreign components:

$$MP_i = \text{domestic } MP_i + \text{foreign } MP_i \quad (B2)$$

or equivalently:

$$MP_i = \underbrace{\sum_j Y_j / D_{i,j}}_{\text{self-potential}} + \underbrace{\left[\sum_f Y_f (D_{i,f})^\beta (T_f)^\gamma \right]}_{\text{foreign MP}} \quad (B3)$$

where Y_j and Y_i are domestic regional GDP estimates ($j \neq i$); $D_{i,j}$ are distances between regions i and j ; $D_{i,i}$ is own distance in region i ; Y_f are GDP estimates of Yugoslavia's main trading partners; $D_{i,f}$ are distance between domestic regional node i and foreign node f ; T_f are trade tariffs of Yugoslavia's main trading partners; β and γ are distance and trade elasticities, respectively.

Starting with domestic market potential we need to obtain regional GDP estimates for eight domestic regions as well as the distances between them. The relevant nodes for the calculation of distances are regional capitals (Belgrade, Herceg Novi, Ljubljana, Novi Sad, Sarajevo, Skopje, Split, and Zagreb) as they were the center of (within region) market activity. The distance matrix (D) is a n times n positive symmetric matrix with element $d_{i,j}$ at location i,j for n regional capitals ($n = 8$). The $d_{i,j}$ elements are constructed using the shortest distance (expressed in kilometers)—via rail, sea or a mix of the two—between i and j , while the diagonal elements $d_{i,i}$ are calculated using the self-distance formula (see equation (B8)). Domestic distance tables ([Ministarstvo saobraćaja 1925, 1930, 1933, 1935, 1937](#)) provide data on railway distances. Maritime distances were obtained from [www.dataloy.com](#).

To calculate regional GDP the methodology of [Geary and Stark \(2002\)](#) was applied. Total Yugoslav GDP (Y_{yug}) can be expressed as the sum of i regional GDPs:

$$Y_{\text{yug}} = \sum_i Y_i \quad (B4)$$

where Y_i is GDP of a region i defined as:

$$Y_i = \sum_j y_{ij} L_{ij} \quad (B5)$$

where y_{ij} is output per worker in region i in sector j and L_{ij} is the corresponding number of workers in region i and sector j . As there are no data available for y_{ij} , this value can be approximated by using Yugoslav sectoral output per worker (y_j) and assuming that regional labor productivity in each sector is reflected by its wage relative to the Yugoslav average (w_i/w_j). Then regional GDP will be given by:

$$Y_i = \sum [y_j \beta_j (w_{ij}/w_j)] L_{ij} \quad (\text{B6})$$

where y_j is Yugoslav output per worker in sector j , w_{ij} is the wage paid in region i in sector j and w_j is the Yugoslav average wage in sector j ; β is a scalar which preserves the relative regional differences but scales the absolute levels so that regional totals for each sector sum to the known Yugoslav total; and L_{ij} is as before the number of workers in region i and sector j .

Thus data on Yugoslav GDP, sectoral output shares, nominal wages by economic sector and region, and active population by economic sector and region are required on a yearly basis. The Yugoslav GDP data come from the updated Maddison dataset (Bolt and van Zanden 2013); the sectoral output shares are taken from Stajić (1959); nominal wages by economic sector and region come from Radnička komora za Hrvatsku i Slavoniju (1929–1941) and Središnji ured za osiguranje radnika (1932–1941); and the number of workers per sector of the economy come from the relevant Censuses of Population for 1931 Kraljevina Jugoslavija (1940) and 1948 FNR Jugoslavija (1954) with yearly data between these dates being linearly interpolated.

The part of domestic market potential comprised of the self-potential of each region can be expressed as:

$$SP_i = Y_i/D_{ii} \quad (\text{B7})$$

where self-potential SP_i is calculated by dividing the estimated GDP of region i with the internal distance of the same region. Following Keeble *et al.* (1982, p. 425) internal distance is estimated as:

$$D_{ii} = 0.333\sqrt{(\text{area}_i/\pi)} \quad (\text{B8})$$

where D_{ii} is the internal distance in region i calculated as one third of the radius of a circle, where area_i is the area (in km^2) of region i . Hence domestic market potential can be represented as:

$$\text{domestic MP}_i = \sum Y_j/D_{ij} + SP_i \quad (\text{B9})$$

Next, foreign market potential has to be added. The pull of a foreign market depends on the size of the foreign market (as measured by GDP) which needs to be reduced by the distance between the domestic and foreign regions and trade tariffs of Yugoslavia's main trading partners. These relations can be represented as:

$$\text{foreign MP}_i = \sum Y_f (D_{i,f})^\beta (T_f)^\gamma \quad (\text{B10})$$

where Y_f , $D_{i,f}$, T_f , β , and γ are as previously defined under equation (B3).

In order to calculate foreign market potential data on GDP and trade tariffs of Yugoslavia's main trading partners, distances between domestic and foreign nodes as well as distance and tariff elasticities are needed. Table B1 shows Yugoslavia's trade shares with main trading partners during 1932–1938. More than half of Yugoslavia's total international trade during the interwar was consistently captured by Austria, Italy, Germany and Czechoslovakia (the observation does not change if only imports or exports are considered). The calculation of foreign market potential relies on the four countries and Britain (which ranks as fifth). The GDP data of these foreign countries come from Maddison (2003) and Bolt and van Zanden (2013). Trade tariffs of foreign countries are measured as $(1+t_f)$ where

t_f is the ratio of customs revenue over value of imports of Yugoslavia's main trading partners. Data for tariff calculations are taken from [Mitchell \(2013\)](#).

Table B1. *Yugoslavia's trade with Austria, Italy, Germany, and Czechoslovakia (as % of total trade value), 1932–1938*

Country	Trade	1932	1935	1938
Austria	Exports to	22.13	14.32	6.06
	Imports from	13.43	11.92	6.88
Italy	Exports to	23.07	16.68	6.42
	Imports from	12.66	10.02	8.94
Germany	Exports to	11.28	18.65	35.94
	Imports from	17.71	16.16	32.52
Czechoslovakia	Exports to	12.17	13.4	7.89
	Imports from	15.63	13.97	10.65

Source: [Kraljevina Jugoslavija \(1932–1941\)](#)

Foreign country capitals (Vienna, Rome, Berlin, Prague, and London) are used as foreign nodes following the logic used for domestic nodes. As with domestic market potential the shortest distance (via rail sea or a mix) is calculated between domestic and foreign nodes. The source for railway distances was [Cook \(1939\)](#) and maritime distances are from [www.dataloy.com](#).

The elasticities of $\beta = -0.8$ and $\gamma = -1$ (for distances and tariffs, respectively) come from the gravity equations (addressing the interwar period) which were calculated by [Esteveadeordal et al. \(2003\)](#).

The standard methodology to construct market potential is based on current prices because this is what mattered to agents at that time ([Crafts 2005](#), p. 1161). GDP in constant terms is preferable over current GDP for the interwar period because of highly volatile exchange rates that could influence the relative size of economies depending on the year selected ([Crafts 2005](#), p. 1161). The final estimates of market potential are expressed in 1990 Geary-Khamis dollars.

Appendix C. Supplementary material

The theoretical model of [Midelfart-Knarvik et al. \(2001, p. 10\)](#) includes regional characteristics, industrial characteristics, and interaction variables. Omitting any of these integral parts from the regression equation estimating the model would mean moving away from the underlying theory. Empirical research (e.g., [Wolf 2007](#), p. 26; [Klein and Crafts 2012](#), p. 786) has demonstrated that the ([Midelfart-Knarvik et al. 2001](#)) regression equation can be estimated by substituting region and industry fixed effects for regional and industrial characteristics. Econometric estimations performed in Section 3.2 relied on the specification with fixed effects. To show that substituting fixed effects with regional and industrial characteristics or dropping time fixed effects does not qualitatively change the results, table C1 reports different models with all eight permutations of regressions with and without region, industry and time fixed effects. As can be seen from table C1 the estimated coefficients remain qualitatively unchanged across the board.

Table C2 reports a robustness check on the stability of parameters of the significant regressors from the baseline pooled OLS and 2SLS estimation to the exclusion of other

regressors. All models in table C2 report only the parameters of the significant explanatory variables. Models 1 and 2 reproduce results from the baseline POLS and 2SLS estimation (model 1 table 8 and model 1 table 9). Models 3, 5, and 7 are estimated with POLS and in turn drop insignificant Heckscher-Ohlin (HO), New Economic Geography (NEG) and both HO and NEG variables. Models 4, 6, and 8 do the same but use 2SLS estimation. Results of this exercise reported in table C2 show that the estimated parameters on the coefficients from the baseline estimation (models 1 and 2) are robust to scaling back the regressions as in models 3 to 8.

Table C1. *Pooled OLS—models with region and industry controls or fixed effects*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Coal energy	−0.0077 (0.215)	−0.0038 (0.361)	−0.0037 (0.368)	−0.0077 (0.216)	−0.0077 (0.218)	−0.0037 (0.368)	−0.0038 (0.360)	−0.0077 (0.218)
Wood energy	0.0030 (0.924)	−0.0036 (0.886)	−0.0078 (0.752)	0.0030 (0.924)	0.0030 (0.924)	−0.0078 (0.752)	−0.0036 (0.886)	0.0030 (0.924)
Unskilled labor	0.0016 (0.699)	0.0020 (0.488)	0.0012 (0.662)	0.0016 (0.699)	0.0016 (0.700)	0.0012 (0.662)	0.0020 (0.488)	0.0016 (0.701)
Human capital	0.0052*** (0.000)	0.0055*** (0.000)	0.0064*** (0.000)	0.0052*** (0.000)	0.0052*** (0.000)	0.0064*** (0.000)	0.0055*** (0.000)	0.0052*** (0.000)
Innovation	0.0004 (0.811)	0.0004 (0.814)	0.0010 (0.491)	0.0004 (0.811)	0.0004 (0.812)	0.0010 (0.491)	0.0004 (0.814)	0.0004 (0.812)
Financial capital	−0.0268 (0.753)	−0.0210 (0.783)	−0.0169 (0.835)	−0.0268 (0.753)	−0.0268 (0.755)	−0.0169 (0.835)	−0.0210 (0.782)	−0.0268 (0.755)
Sales linkages	0.3579 (0.864)	0.3339 (0.877)	−1.5245 (0.315)	0.3579 (0.864)	0.3579 (0.865)	−1.5245 (0.315)	0.3339 (0.877)	0.3579 (0.865)
Input linkages	3.6355*** (0.003)	3.5141*** (0.004)	2.1789* (0.054)	3.6355*** (0.003)	3.6355*** (0.003)	2.1789* (0.055)	3.5141*** (0.004)	3.6355*** (0.003)
Path dependence	0.4669*** (0.002)	0.3832*** (0.000)	0.4082*** (0.000)	0.4669*** (0.002)	0.4669*** (0.002)	0.4082*** (0.000)	0.3832*** (0.000)	0.4669*** (0.002)
Region FE	No	Yes	Yes	No	No	Yes	Yes	No
Industry FE	No	Yes	No	Yes	No	Yes	No	Yes
Time FE	No	Yes	No	No	Yes	No	Yes	Yes
Observations	640	640	640	640	640	640	640	640
R ²	0.577	0.609	0.605	0.577	0.583	0.606	0.608	0.583

Notes: *, **, and *** statistical significance levels of 10, 5, and 1 percent, respectively. *p*-values in parentheses. Models that do not include fixed effects include region and/or industry controls instead.

Table C2. *Scaling back regressions*

	(1) POLS	(2) 2SLS	(3) POLS	(4) 2SLS	(5) POLS	(6) 2SLS	(7) POLS	(8) 2SLS
Human capital	0.0055*** (0.000)	0.0057*** (0.000)	0.0061*** (0.000)	0.0064*** (0.000)	0.0056*** (0.000)	0.0052*** (0.000)	0.0062*** (0.000)	0.0059*** (0.000)
Input linkages	3.5141*** (0.004)	4.9136*** (0.000)	3.3119*** (0.002)	4.5433*** (0.000)	3.4769*** (0.007)	5.1979*** (0.000)	3.2777*** (0.002)	4.7086*** (0.000)
Path dependence	0.3832*** (0.000)	0.3852*** (0.000)	0.3806*** (0.000)	0.3837*** (0.000)	0.3837*** (0.000)	0.3824*** (0.000)	0.3817*** (0.000)	0.3798*** (0.000)
Dropped other HO regressors	No	No	Yes	Yes	No	No	Yes	Yes
Dropped other NEG regressors	No	No	No	No	Yes	Yes	Yes	Yes
Region, industry, and time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	640	640	640	640	640	640	640	640
R^2 (centered R^2 for IV models)	0.609	0.089	0.607	0.125	0.609	0.092	0.607	0.128

Notes: ***Statistical significance at the one percent level. p -values in parentheses.