Working Paper No. 1049

Deindustrialization from the Center Perspective: US Trade and Manufacturing in the Last Two Decades

by

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May 2024

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We are grateful to Michalis Nikiforos and the participants at the 2024 EEA Conference for their useful comments on the first draft of this paper. Of course, any remaining mistakes should be attributed to ourselves.

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ISSN 1547-366X

ABSTRACT

We argue that the US trade and industry sector has experienced several unsustainable sectoral processes, including (i) a fall in the trade balance in machinery and equipment and high-tech (HT) industries, (ii) a rise in import multipliers in machinery and equipment and HT industries, (iii) a fall in the manufacturing share of GDP in machinery and equipment and HT industries, (iv) a rise in commodities share of GDP, (v) a fall in the wage share, (vi) structural shifts in the consumption share of wages, and (vii) a fall in employment multipliers for the US, particularly in manufacturing. To address these issues, the US must shift toward a more sustainable and value-added economy with a focus on innovation and investment in high-tech industries, renewable energy, and sustainable agriculture. Additionally, policies must be put in place to address the negative impacts of resource extraction and to promote a more equitable distribution of income and wealth.

KEYWORDS: Input–Output Analysis; Industrial Policy; Income distribution

JEL CODES: C67; D57; O25; D33

INTRODUCTION

The US economy in the last two decades has experienced a number of ups and downs, including major events such as the dot-com bubble in the early 2000s, the Great Recession in 2008–09, and the COVID-19 pandemic in 2020. Drawing upon an input–output framework, this paper analyzes the intersectoral structure of the US economy, using the data from the OECD IO tables for the past two decades. In particular, we argue that the US trade deficit has been affected by the decline in the US manufacturing share of GDP in the past two decades. For this purpose, we employ, among others, a model of matrix multipliers which, except for the technical conditions of production, also considers imports, income distribution, savings, and consumption patterns out of wages and profits.

Thus, this article focuses on intersectoral analysis and especially on estimation of output, employment and import multipliers, departing from the classical assumption of the saving propensity out of profits (wages) equal to one (zero) and a common consumption pattern (out of wages and profits). The primary consideration of our results aims to provide insights for policy makers to facilitate their evaluation of different plans to combine growth and economic efficiency with social cohesion and justice. For those reasons, our empirical evidence is presented in a simple and easy way that allows policy makers the evaluation of any possible recovery and sustainable program.

The analysis revealed that the US trade and industry sector has experienced several unsustainable sectoral processes, including (i) a fall in the trade balance in machinery and equipment and high-tech (HT) industries, (ii) a rise in import multipliers in the machinery and equipment and HT industries, (iii) a fall in manufacturing share of GDP in the machinery and equipment and HT industries, (iv) a rise in commodities share of GDP, (v) a fall in the wage share, (vi) structural shifts in the consumption share of wages, and (vii) a fall in employment multipliers for the US, particularly in manufacturing.

The fall in the trade balance in the machinery and equipment and HT industries has resulted in a negative impact on the US economy, as the US imports more machinery and equipment than it exports. This has been further compounded by the rise in import multipliers in these sectors, which means that an increase in imports results in a greater decrease in domestic production. Additionally, the fall in manufacturing share of GDP in these sectors has led to a decrease in the overall contribution of manufacturing to the US economy. The rise in commodities share of GDP and commodities trade balance has led to an unsustainable focus on resource extraction and exportation, rather than investment in value-added industries.

Furthermore, the fall in the consumption share of wages has had a negative impact on the US economy, as households have less disposable income to spend on goods and services. This has led to a decrease in domestic demand and a decrease in economic growth. The fall, finally, in employment multipliers, particularly in manufacturing, has led to a decrease in job creation ability and can lead to a decline in the overall contribution of manufacturing to employment in the US. This can be further exacerbated by the increase in automation and offshoring of manufacturing jobs, which negatively impacts the US workforce.

To sum up, the unsustainable sectoral processes within the US trade and industry sector have had a significant negative impact on the US economy, including a decrease in employment and economic growth. In order to address these issues, the US must shift toward a more sustainable and value-added economy, with a focus on innovation and investment in high-tech industries, renewable energy, and sustainable agriculture. Additionally, policies must be put in place to address the negative impacts of resource extraction and promote a more equitable distribution of income and wealth. By addressing these unsustainable sectoral processes, the US can create a more resilient and sustainable economy for the future.

For this purpose, we follow the approach of Rodousakis, Yajima, and Soklis (2023), i.e. we use an analytic framework inspired by the concept of the Sraffian multiplier (Kurz 1985; Metcalfe and Steedman 1981; Mariolis 2008) and data from the Symmetric Input Output Tables (SIOTs) for all the available years provided via the Organisation for Economic Co-operation and Development (OECD) website.[1] We further use a modification of Rodrik's (2016) approach to test the levels of development of the US economy through a panel data analysis.

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[1] https://stats.oecd.org

The remainder of the article is structured as follows. The second section presents the method. The third section presents the empirical estimations. The fourth section concludes.

THEORETICAL FRAMEWORK

We consider an open, linear economy involving only single products, i.e., “basic” commodities (in the sense of Sraffa [1960]). Also, we assume that (i) all capital is circulating, (ii) the input–output coefficients are fixed; (iii) there are non-competitive imports, (iv) the net product is distributed to profits and wages that are paid at the end of the common production period, (v) the price of a commodity obtained as an output at the end of the production period is the same as the price of that commodity used as an input at the beginning of that period (“stationary prices”), and (vi) labor is homogeneous within each industry but heterogeneous across industries.

On the basis of these assumptions, the price side of the system is described by:

$$\mathbf{p} = \mathbf{pA}[\mathbf{I} + \hat{\mathbf{r}}] + \mathbf{w}\hat{\mathbf{l}} \qquad (1)$$

where $\mathbf{p}$ ($> \mathbf{0}$) is the 1 ×n vector of commodity prices, $\mathbf{A}$ ($\geq \mathbf{0}$) is the n × n matrix of total input–output coefficients, $\mathbf{I}$ is the n × n identity matrix, $\hat{\mathbf{r}}$ ($\neq \mathbf{0}$ and $r_j > -1$) is the n × n diagonal matrix of the sectoral profit rates, $\mathbf{w}$ ($w_j > 0$) is the vector of money wage rates, and $\hat{\mathbf{l}}$($l_j > 0$) is the n x n diagonal matrix of direct labor coefficients. The quantity side of the system is described by

$$\mathbf{x}^{\mathrm{T}} = \mathbf{Ax}^{\mathrm{T}} + \mathbf{y}^{\mathrm{T}} \qquad (2)$$

or

$$\mathbf{y}^{\mathrm{T}} = \mathbf{c}_w^{\mathrm{T}} + \mathbf{c}_p^{\mathrm{T}} - \mathbf{im}^{\mathrm{T}} + \mathbf{d}^{\mathrm{T}} \qquad (3)$$

where $\mathbf{x}^{\mathrm{T}}$ denotes the gross output vector, $\mathbf{y}^{\mathrm{T}}$ is the n ×1 vector of net output, $\mathbf{c}_w^{\mathrm{T}}$ $(\mathbf{c}_p^{\mathrm{T}})$ the vector of consumption demand out of wages (profits), $\mathbf{im}^{\mathrm{T}}$ is the import demand vector, and $\mathbf{d}^{\mathrm{T}}$ is the autonomous demand vector (government expenditures, investments and exports). From equation (3) and given that $\mathbf{L}^{\mathrm{T}} = \hat{\mathbf{l}}\mathbf{x}^{\mathrm{T}}$ denotes the vector of sectoral employment, we drive the equation

$$\mathbf{L}^{\mathrm{T}} \equiv \mathbf{\Lambda\Pi d}^{\mathrm{T}} \qquad (4)$$

where $\mathbf{\Lambda\Pi}$ denotes the $n \times n$ matrix of employment multipliers linking autonomous investments to total employment. Furthermore, we derive the matrix multiplier linking autonomous demand to imports as

$$\mathbf{im}^{\mathrm{T}} = \hat{\mathbf{m}}[\mathbf{I} - \mathbf{A}]^{-1}\mathbf{\Pi d}^{\mathrm{T}} \qquad (5)$$

Where $\hat{\mathbf{m}}[\mathbf{I} - \mathbf{A}]^{-1}\mathbf{\Pi}$ denotes the $n \times n$ matrix of import multipliers linking autonomous demand to imports.

Finally, in the closed economy case, i.e., for $\hat{\mathbf{m}} = \mathbf{0}$, the matrix of multipliers reduces to $\mathbf{\Pi} \equiv [\mathbf{I} - \mathbf{C}]^{-1}$ and thus equations (3) and (4) become

$$\mathbf{y}^{\mathrm{T}} = \mathbf{\Pi d}^{\mathrm{T}} \qquad (3a)$$

$$\mathbf{L}^{\mathrm{T}} \equiv \mathbf{\Lambda\Pi d}^{\mathrm{T}} \qquad (4a)$$

EMPIRICAL FINDINGS

We apply the previous analysis to the SIOTs of the US economy. So, in what follows we can focus on the seven unsustainable sectoral processes:

First Process: Trade Deterioration in HT Industries

For the 1998–2008 period, the US economy experienced a process of trade account deterioration which was interrupted with the onset of the Global Financial Crisis (see Figure 1). One of the most interesting stylized facts of the post-GFC environment was the reverse hysteresis process that took place in the trade deficit, as following the recovery in the early 2010s, the overall balance had remained stable around 2 percent of GDP. This was due to impressive recovery of the primary-sector trade balance, which in 2018 had almost recovered its 1998 levels, after reaching –35 percent of GDP in 2008. On the other hand, the secondary sector trade balance has steadily decreased since 1998 from less than –5 percent of GDP at the beginning of our sample to –10 percent after two decades, falling slightly behind since 2017 with respect to the primary-sector trade deficit, as the service-sector balance has turned into positive territory since 2011. The reason for the trade deficit doubling in the secondary sector could be grasped from the behavior of the manufacturing activities. As a matter of fact, by breaking down the manufacturing sector by its main components, it is possible to observe that both machinery and equipment and other manufacturing activities have moved from a single digit deficit to a double digit one, with the former dropping to –22 percent of their GDP. Material manufacturing, on the other hand, has managed a recovery since the GFC, averaging –5 percent in the 2010–18 period.

From the technological standpoint, this is reflected in a similar deterioration of both high- and low-tech trade manufacturing deficits from –5 and –7 percent to –18 and –16 percent, respectively, with a brief interruption in 2008. Medium tech, conversely, has since reversed this trend, though reached a plateau at –4 percent of GDP since 2014. It should be pointed out that, in both medium tech and material manufacturing, coke and refined petroleum products are included—responsible for the bulk of the improvement in the trade balance, as we will cover in the next sections. Moreover, if we adopt a broader definition of technological activities following the modified Pavitt taxonomy proposed by Pianta and Bogliacino (2016), a similar picture emerges, with science-based sectors having dramatically increased their deficit from 2 to 14 percent and specialized suppliers breaking down from having even a slight positive surplus in the late 90s. Less Research and Development (R&D) intensive and more traditional sectors such as suppliers-dominated and scale- and information-intensive activities have maintained a slightly negative balance over these two decades, with the latter group having fully reversed their decreasing pre-2008 trend, thanks again to the contributions of coke and refined petroleum.

Figure 1a. Trade Deterioration in Productive Sectors

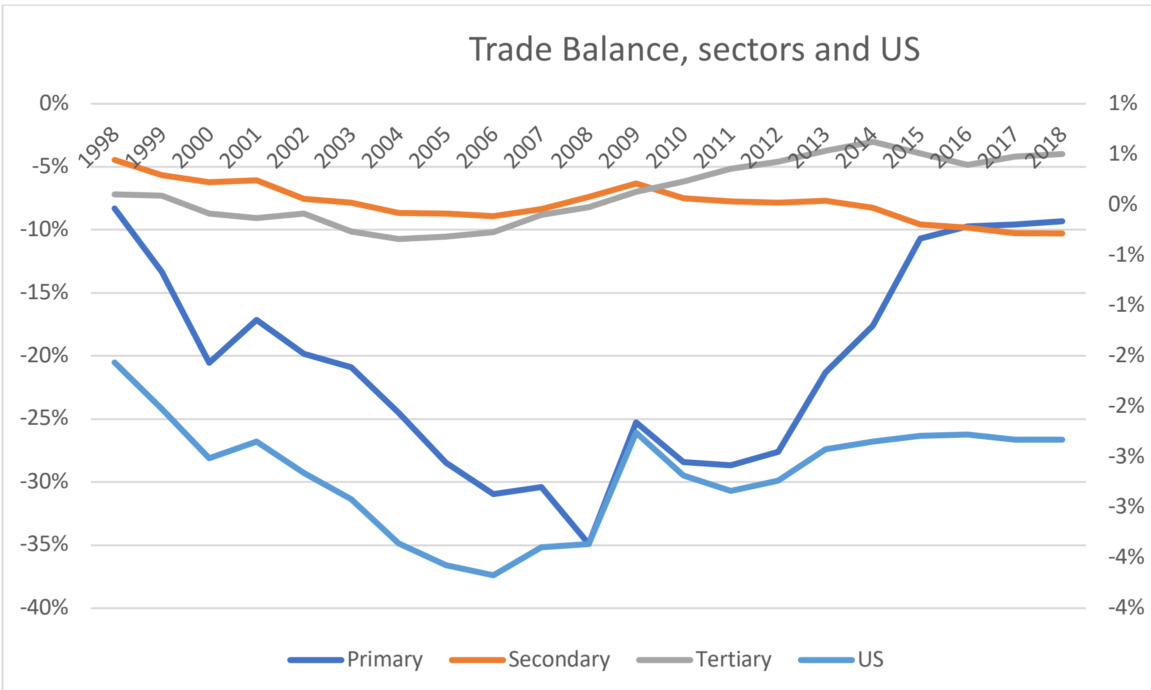


Figure 1b. Trade Deterioration in Manufacturing

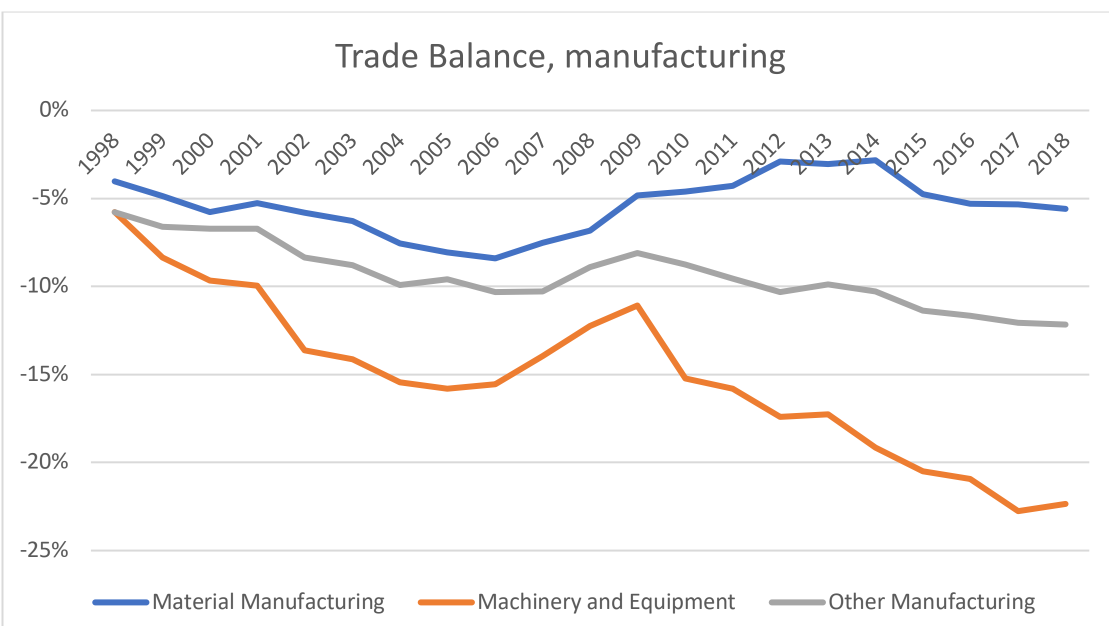


Figure 1c. Trade Deterioration in Activities by Pavitt

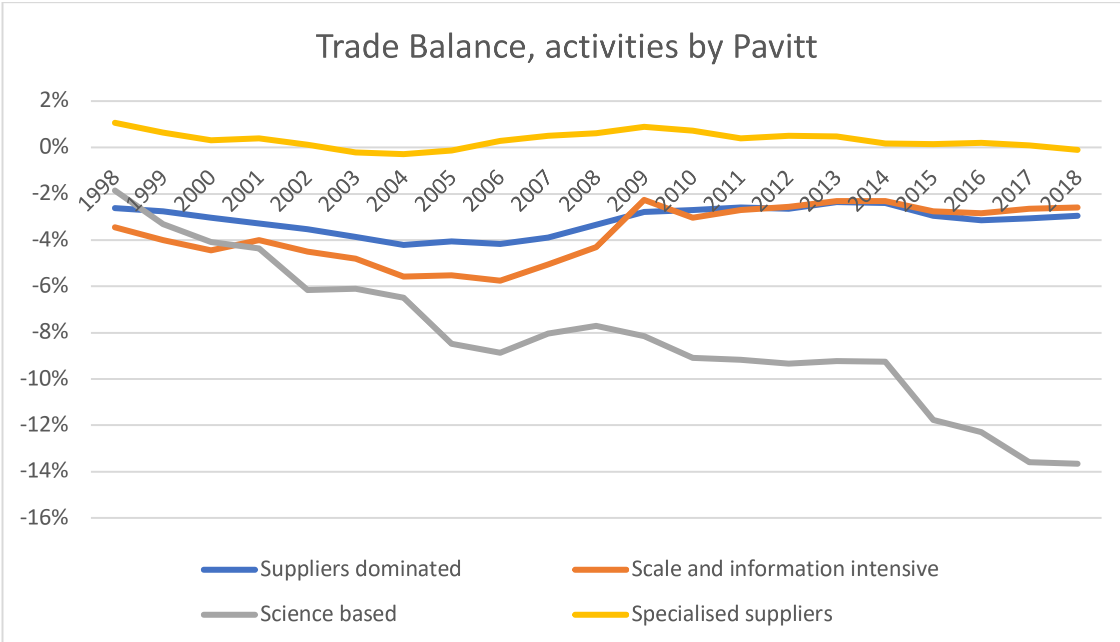
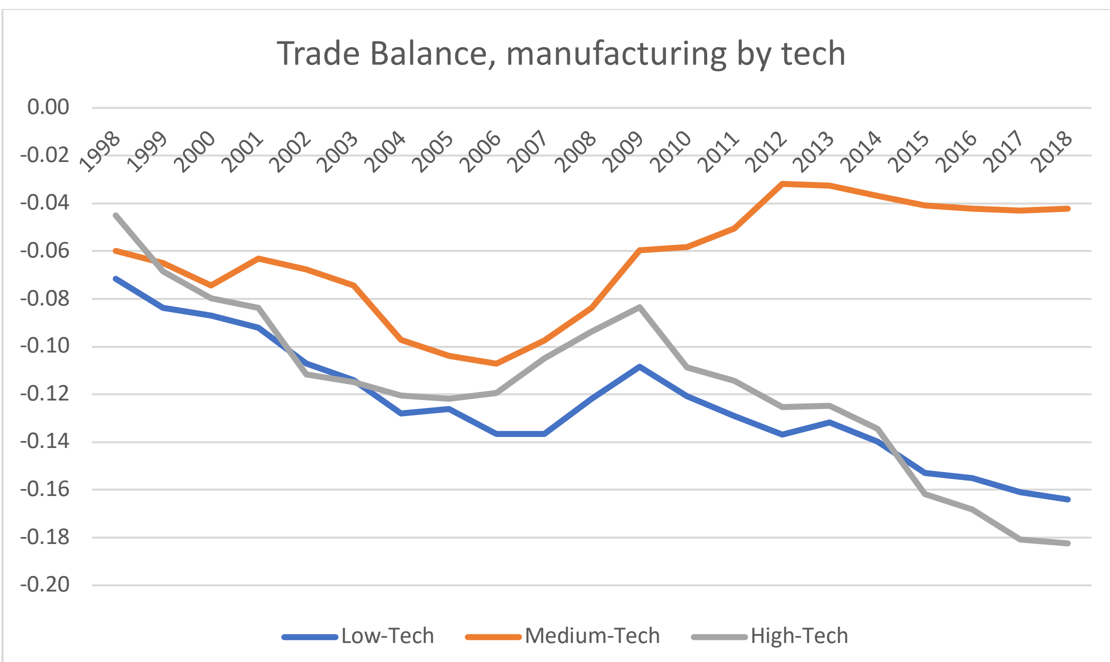


Figure 1d. Trade Deterioration in Manufacturing by Tech



If we finally disentangle the activities even further by looking at the specific components of machinery and equipment, high-tech manufacturing, and science-based activities, we could unfold the dramatic rise in the deficit (–6 to –48 percent) for computer, electronic, and optical equipment. This is the common component of the three definitions that we have adopted so far (see Figure 1). A similar fate has been shared by electrical equipment (–7 to –48 percent), and, to a lesser degree, by motor vehicles, trailers, and semi-trailers (–18 to –30 percent) and pharmaceutical products (–0.06 to –28 percent), with the former starting off from a historically high level of trade deficit with respect to GDP.

Figure 2a. Trade Deterioration in Machinery and Equipment

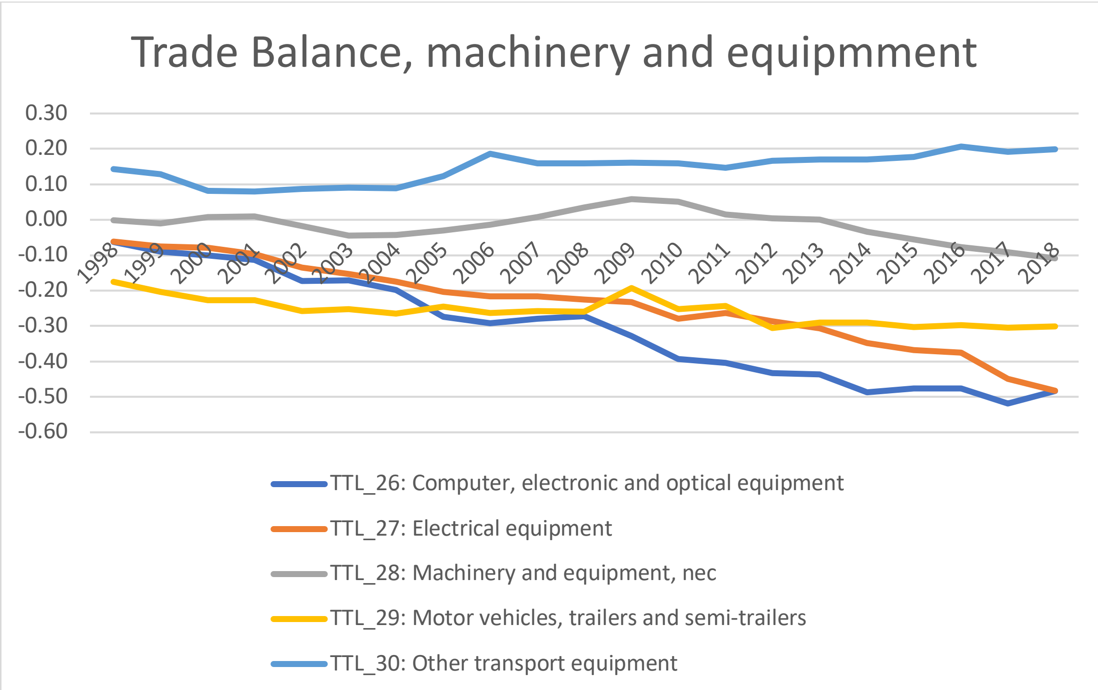


Figure 2b. Trade Deterioration in HT Manufacturing

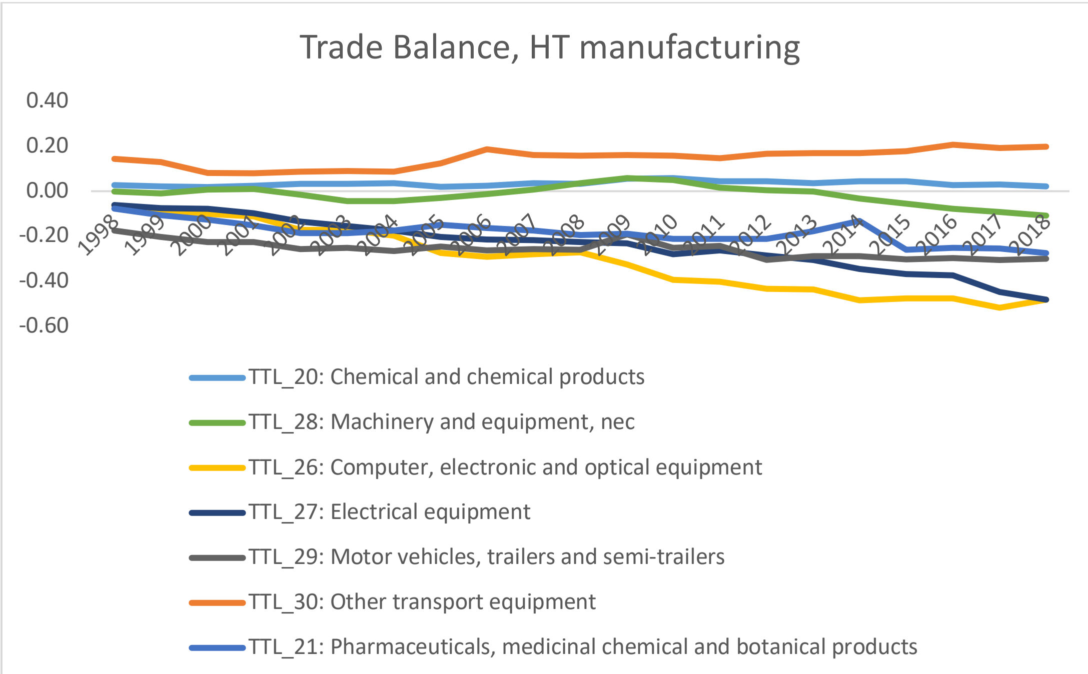
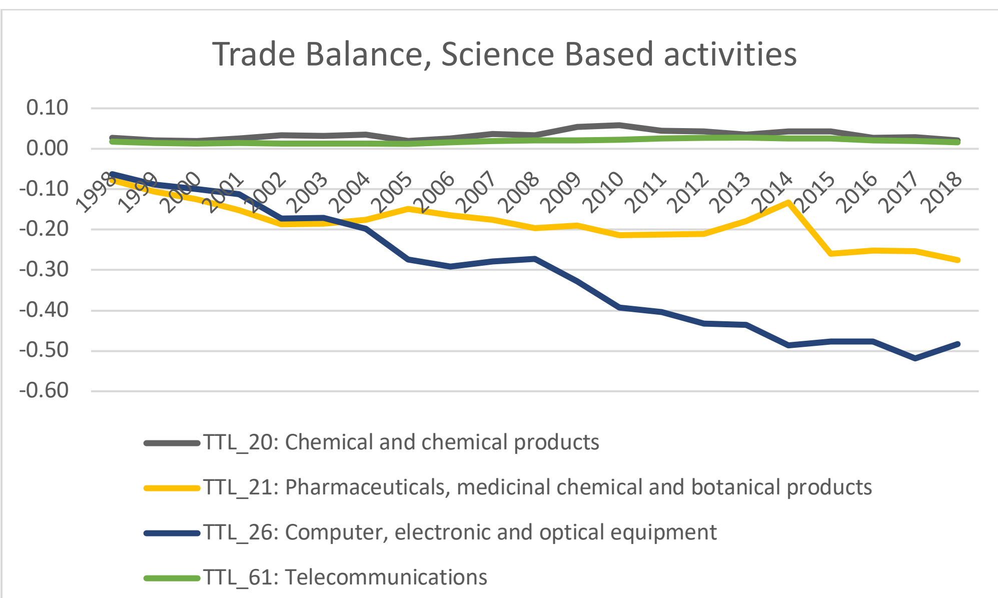


Figure 2c. Trade Deterioration in Science Based Activities



Second Process: Rise in Import Multipliers in HT

The second process—experienced by the sectors of the US economy since 1998—has been the increase in their import multipliers (see Figure 3). The trend is particularly evident, again in the secondary sector, which has shifted to a multiplier of 0.24 to 0.31 in two decades, after a small drop in 2008. The primary sector, after a steady rise for the 1998–2008 decades, has since managed to reduce its import dependency to almost the same level of the late 90s. Moreover, the tertiary sector has marginally increased its propensity, although it continues to be comparatively low with respect to the other two macro sectors. If we turn to the different kinds of manufacturing activities, we notice a similar behavior in machinery and equipment propensity, having risen to 0.35 to 0.44 and in other manufacturing (0.23 to 0.32), while material manufacturing has managed to arrest this increasing trend, although not revert it completely. Similarly, medium-tech manufacturing has maintained a steady import dependency in contrast with both the high- and low-tech industries, as the latter now is closer in terms of its propensity to import than it was 20 years ago with respect to the high-tech one. From the lens of the Pavitt taxonomy, both science-based and specialized suppliers shared the fate of high-tech manufacturing, as both suppliers dominated while the scale and information intensive have reached a plateau since the GFC. Looking at the single components of machinery and equipment, high-tech manufacturing, and science-based sectors, we noticed again the dramatic rise in computer, electronic, and optical equipment propensity (0.36 to 0.49), although that of electrical equipment has been even more dramatic (0.31 to 0.50), catching up in 2018 with the propensity of motor vehicles, trailers, and semi-trailers. To a lesser degree, pharmaceutical products have increased their dependency to imported inputs (0.24 to 0.41), as chemicals which were starting off from similar levels have instead averaged at its 2008 import propensity (0.3).

Figure 3a. Import Multipliers in Productive Sectors

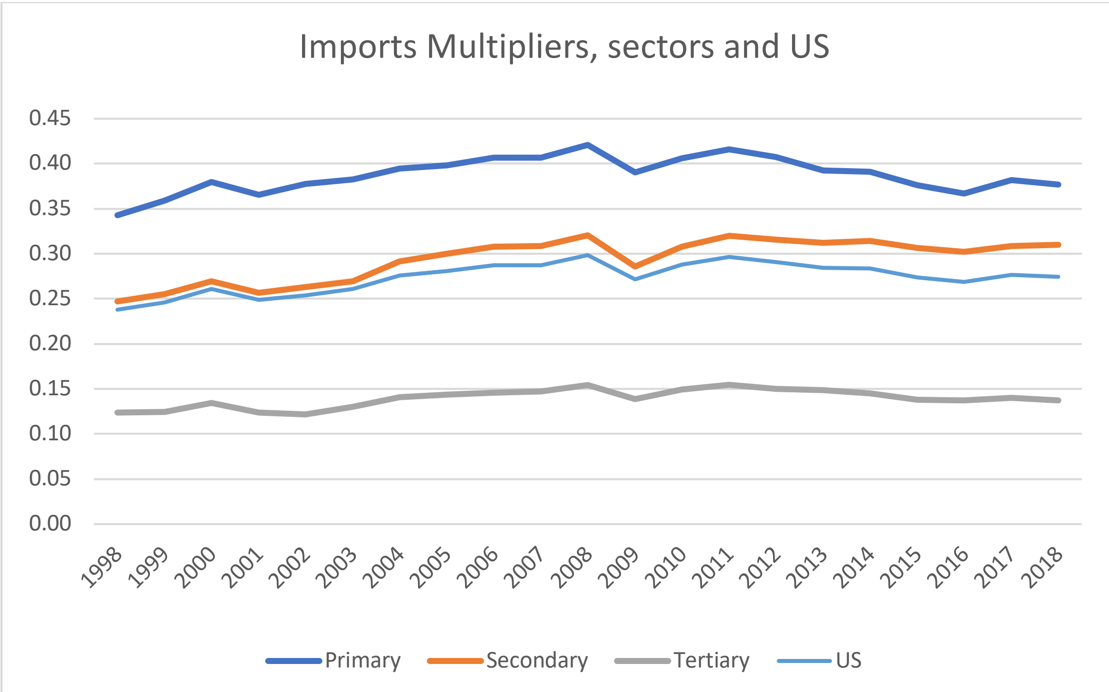


Figure 3b. Import Multipliers in Manufacturing

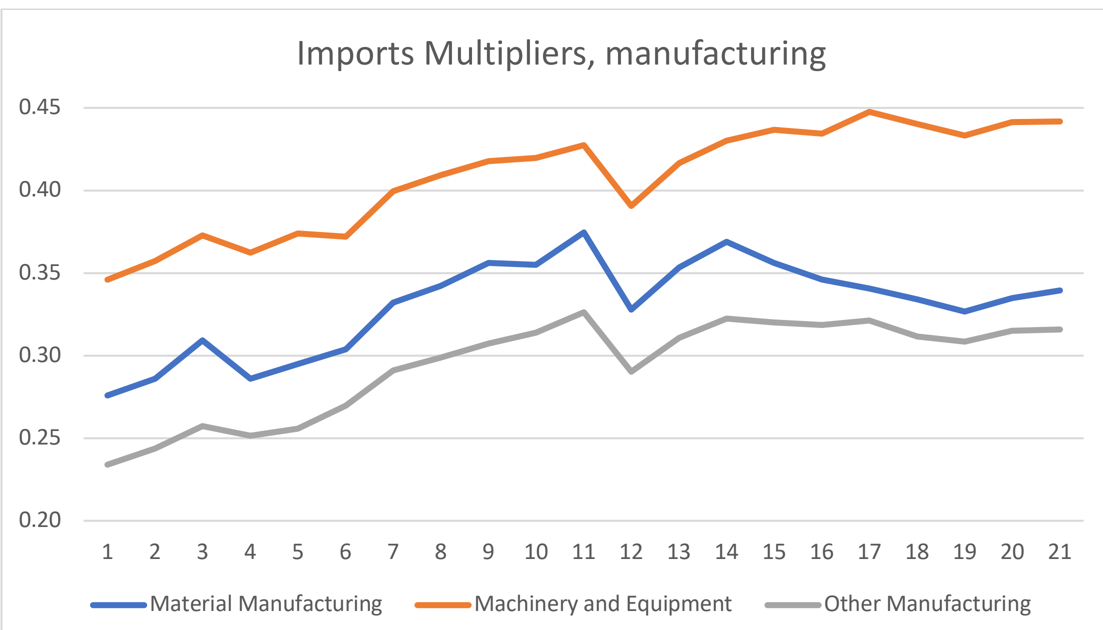


Figure c3. Import Multipliers in Manufacturing by Tech

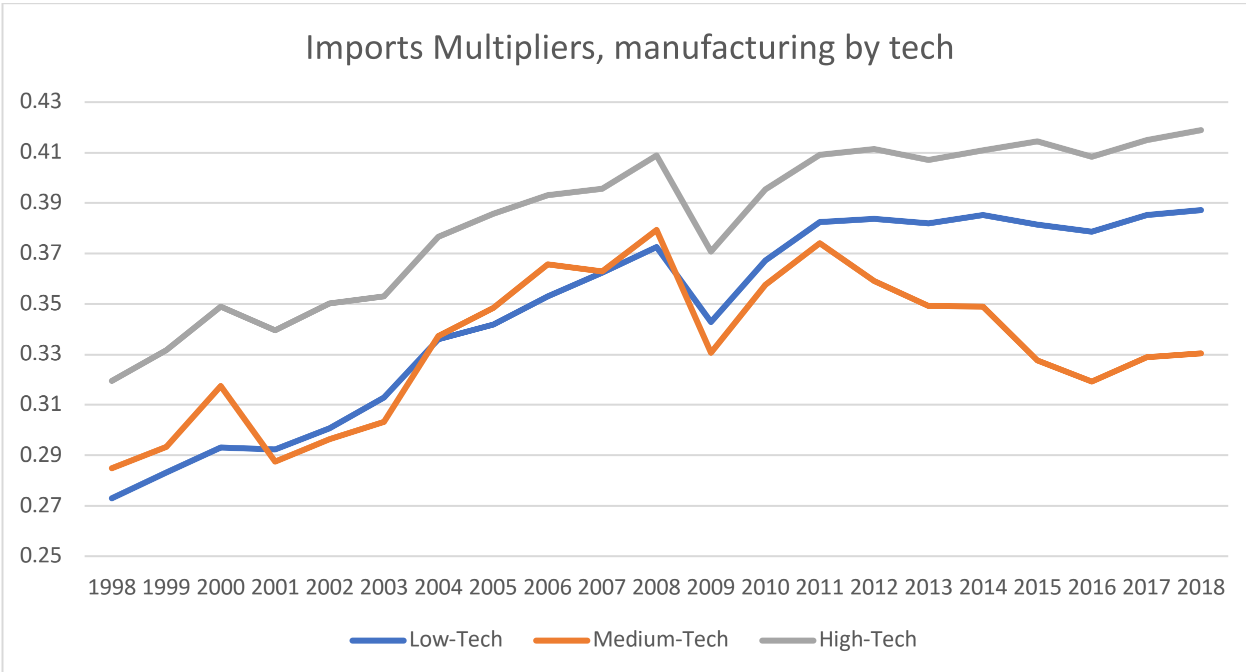


Figure 3d. Import Multipliers in Activities by Pavitt;

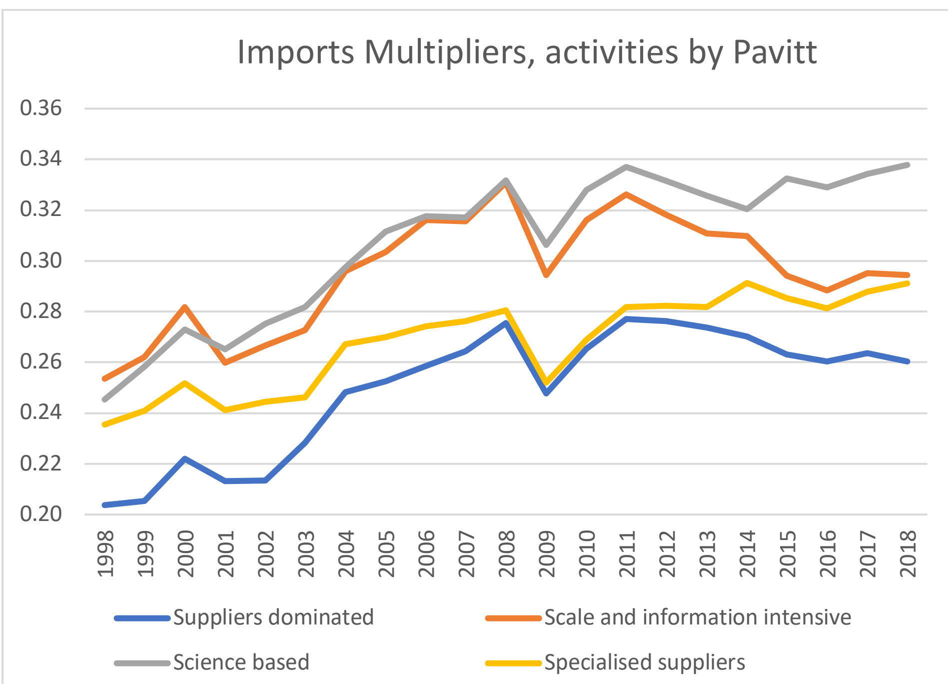


Figure 3e. Import Multipliers in Machinery and Equipment

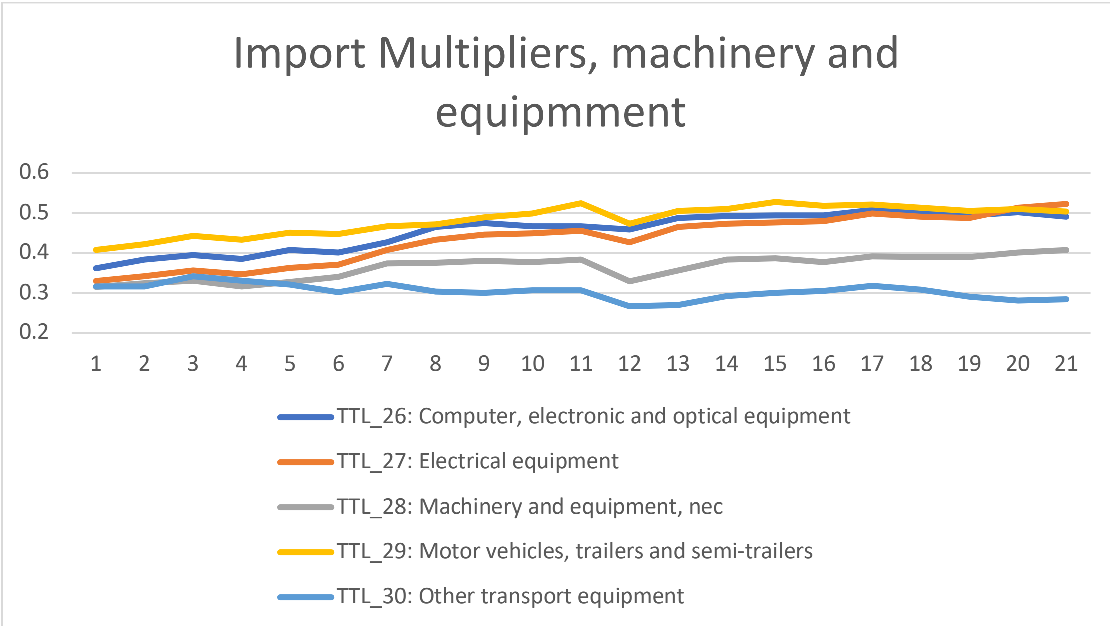


Figure 3f. Import Multipliers in HT Manufacturing;

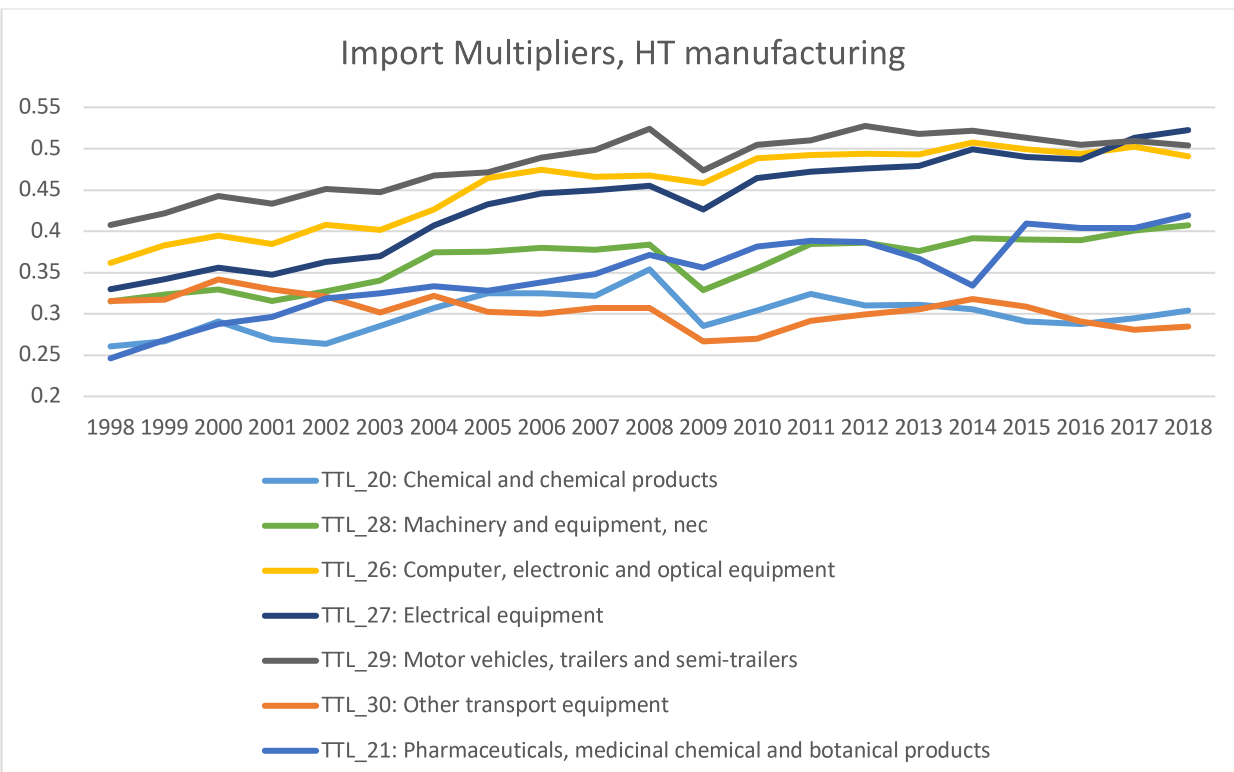
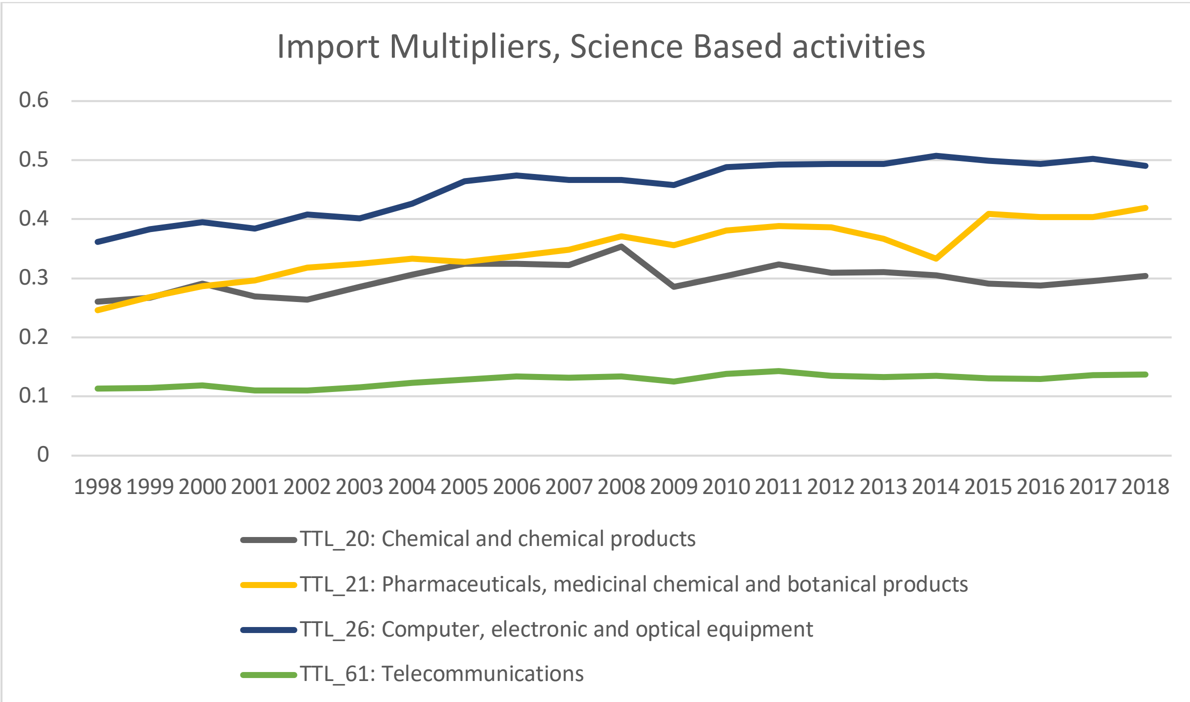


Figure 3g. Import Multipliers in Science-Based Activities



Third Process: Drop in Manufacturing Share of GDP

If we observe the behavior of the manufacturing share on GDP of the macro-productive sectors, we note how the de-industrialization trend—i.e., the reduction of the participation of secondary activities in GDP—has become more pronounced since the GFC (see Figure 4). Most secondary industry losses have been absorbed by the tertiary sector, whereas primary industries have maintained, perhaps surprisingly, a constant share on US GDP. When we delve into the manufacturing sector, however, we could grasp more clearly the process pointed out by Rodrik (2016), although with some peculiarities. For instance, although the falls of both machinery and equipment and other manufacturing were similar (10 to 6 percent), the first decreased its participation more dramatically until 2008, and has since maintained a constant share on GDP where the latter has reduced more steadily. Material manufacturing on the other hand has experienced an increase to 9 percent in 2008, and, after a drop in 2008, remained relatively stable until 2014—though, there was a sudden drop to 7 percent after 2014. Again, a similar trend is mirrored in medium-tech manufacturing, as both low- and high-tech have been reducing their participation in GDP a constant rate. The negative shift in the manufacturing share on GDP of high-tech industries (8 percent from 12 percent) partially contradicts the trend observed by Dosi et al. (2022) and Tregenna et al. (2020) for these kinds of activities. Again, if we move our focus to the more innovative sectors, computers have decreased their participation in GDP to 1 percent after maintaining a constant 3 percent share for 1998–2000. Motor vehicles, although beginning from a similar share, have instead managed a partial rebound after 2008.

Figure 4a. Shares of GDP: Productive Sectors

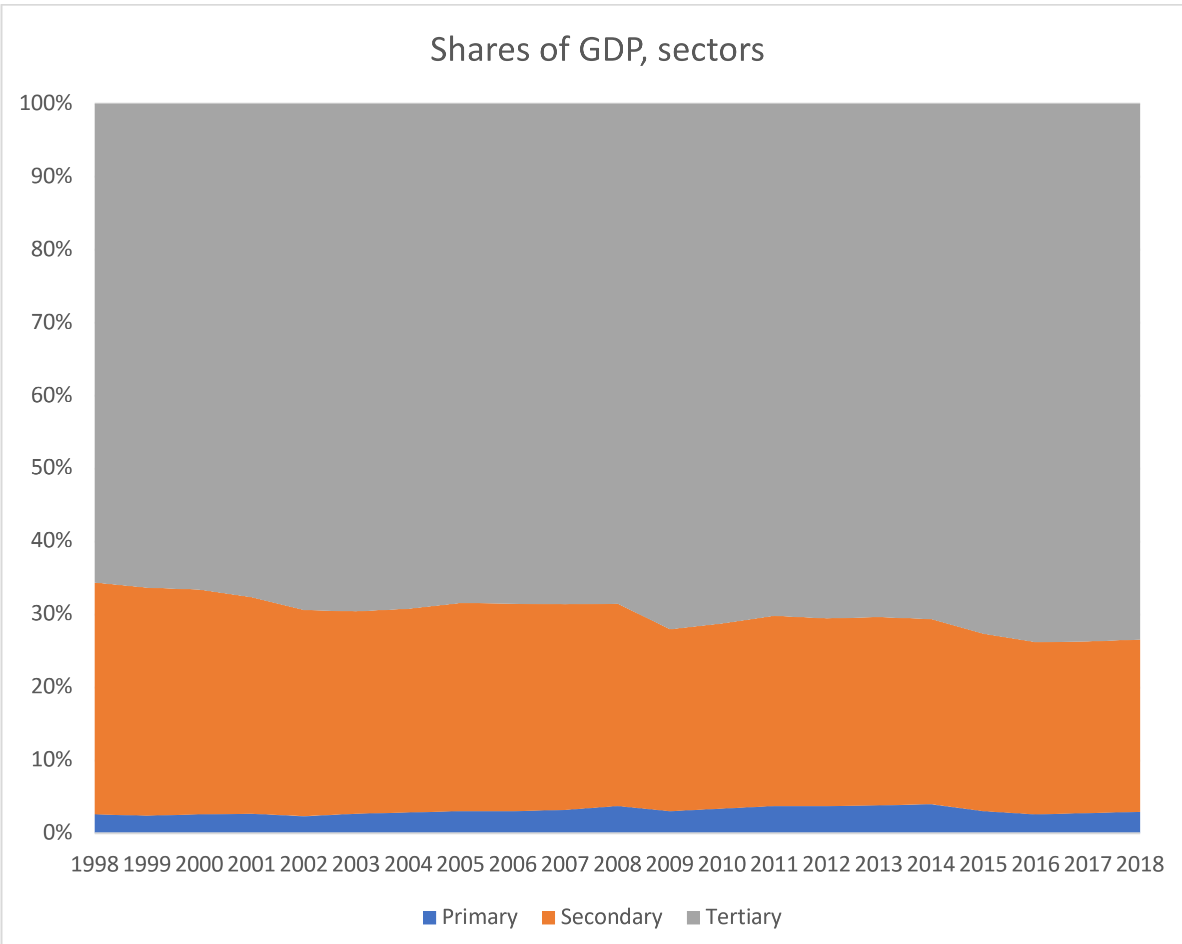


Figure 4b. Shares of GDP Manufacturing

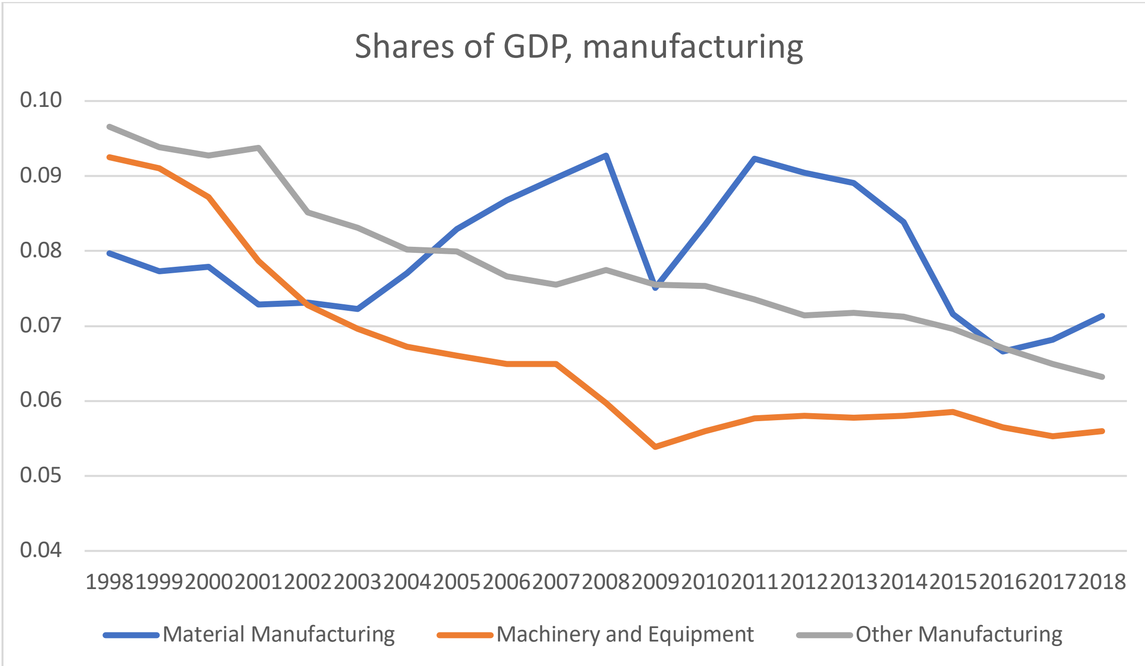


Figure 4c. Shares of GDP: Manufacturing by Tech

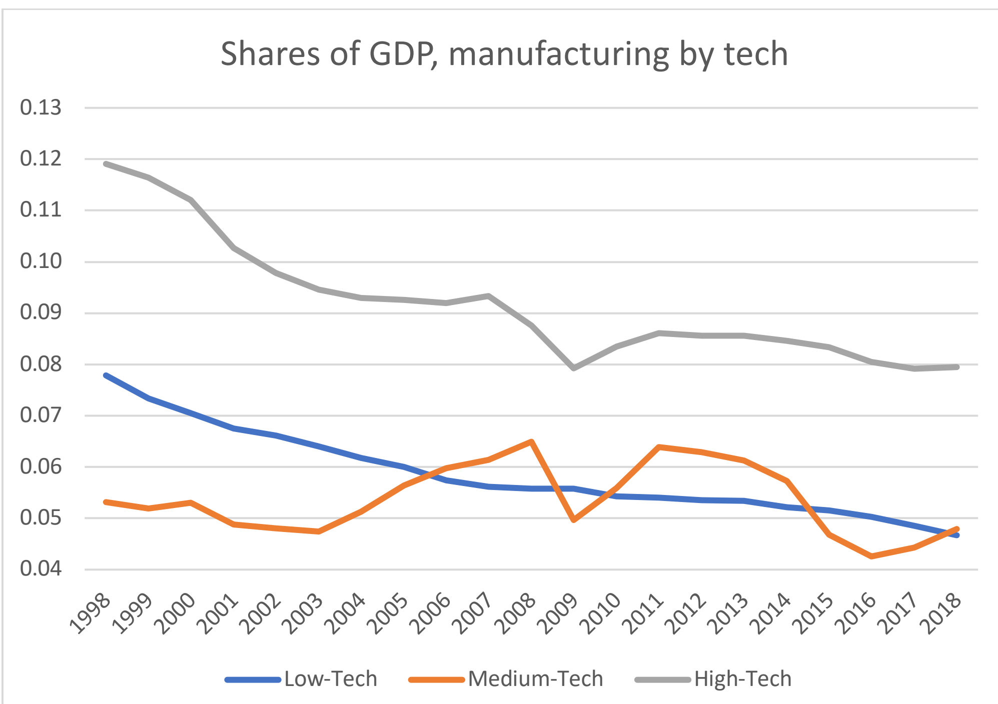


Figure 4d. Shares of GDP: Activities by Pavitt;

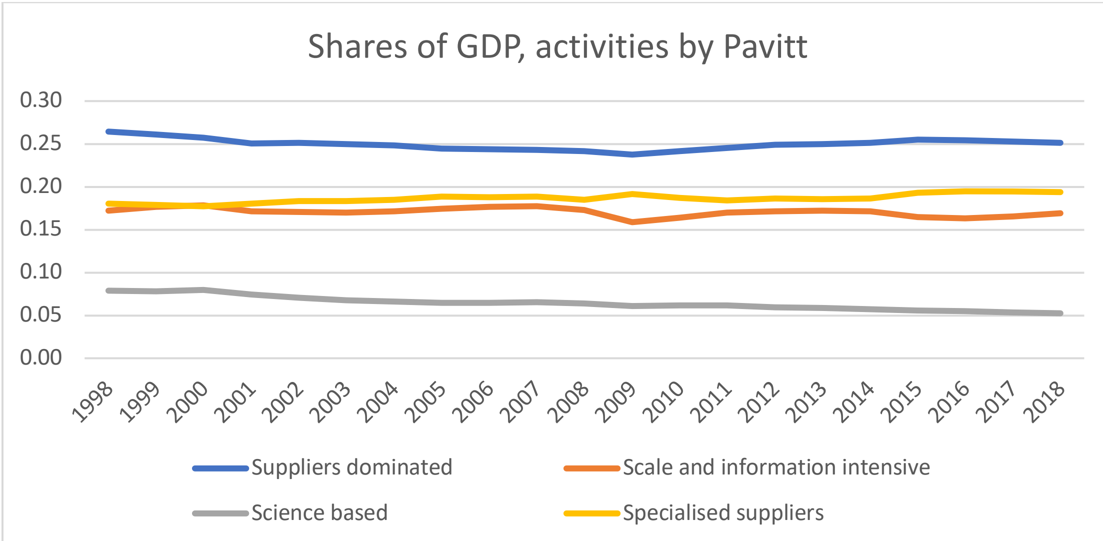


Figure 4e. Shares of GDP: Machinery and Equipment

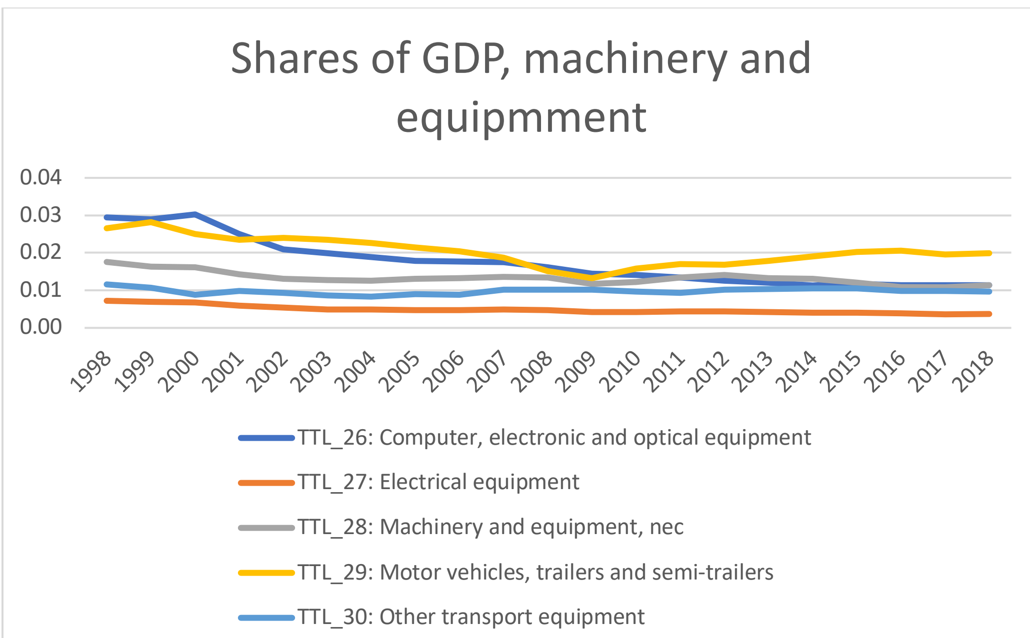


Figure 4f. Shares of GDP: HT Manufacturing

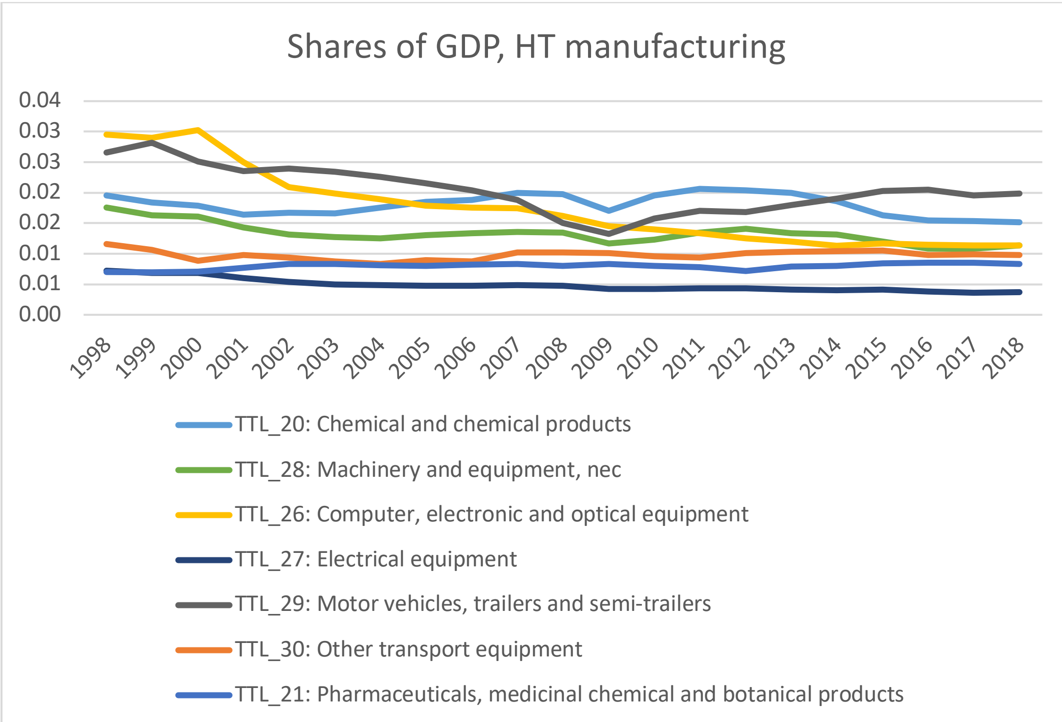
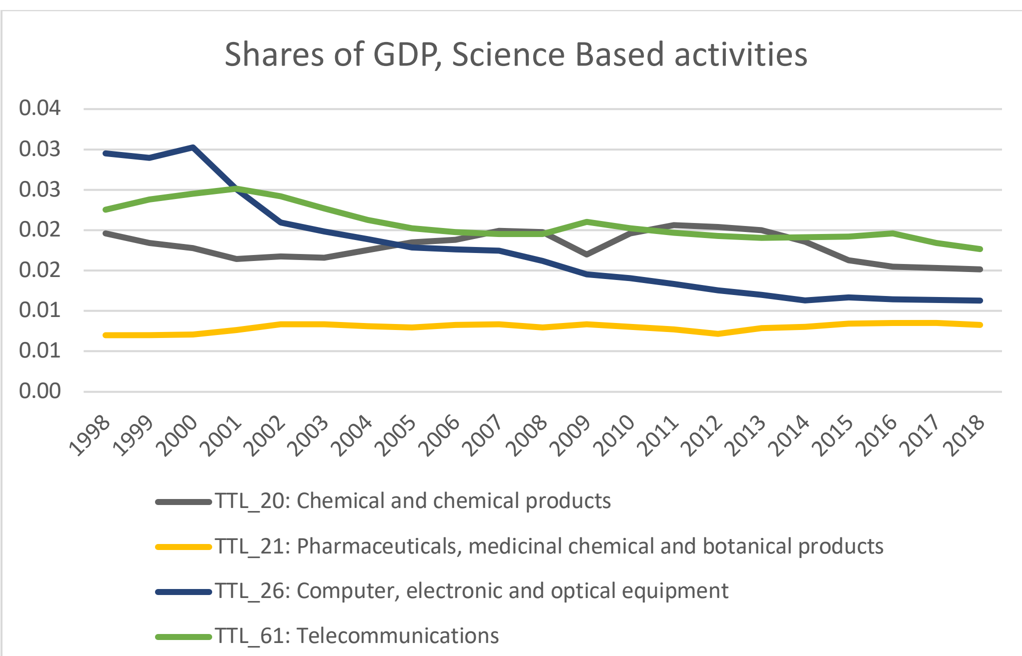


Figure 4g. Shares of GDP: Science-Based Activities



Fourth Process: The Rise in Commodities

One of the most distinctive features of the US economy in 1998–2018 has been the increasing importance in the energy sector, and, in particular, of coke and refined petroleum products (see Figure 5). Yet this process of specialization has suffered several sudden stops and carried out some contradictory trends. For instance, energy–producing activities doubled their share on GDP for the 1998–2007 period (from 3 to 6 percent). However, after 2014 it collapsed to 3 percent and rebounded subsequently to 4 percent. A similar trend may be observed for petroleum, whose share on GDP has fluctuated from 1 to 3 percent, and, to a lesser extent, for energy mining, whose share has gravitated around the 1 percent threshold. Interestingly, electricity participation on GDP, which rose until 2000, has since decreased its share to 1 percent. From the standpoint of the trade balance, however, the success of energy producing activities and petroleum is more evident, with the latter sector having managed to become a net exporter as its trade balance now totals 5 percent of GDP (from –10 percent in 1998). Even more impressive was the recovery of the trade balance of energy mining, which after having deteriorated to –85 percent in 2007 from –40 percent in 1998 has since recovered to –24 percent. As a result, the overall energy balance has improved to –4 from –10 percent in 1998. Another relevant stylized fact is that, this re-primarization process was characterized by a steady increase in import multipliers until 2008 in both energy mining and petroleum (and to a lesser degree also electricity), which was reverted in the aftermath of the GFC. After a sudden fall in 2015, import multipliers in energy have remained constant, broadly settling to their 1998 levels (0.3 for the industry as a whole and 0.35 and 0.42 for petroleum and energy mining, respectively). A different picture emerges when assessing sectoral employment multipliers and wage shares for the energy sector, with the former having suffered a steady decline over the first decade of our sample and having achieved a plateau at 8.9 down to 16 percent. The wage share has instead taken on a more instable behavior, ranging from 7 to 11 percent and they are now lower than their 1998 levels. The equivalent shares of the mining sectors have been more volatile—7 to 17 percent—as petroleum has remained comparatively low with respect to the other energy industries, barely making 2 percent (up from 4 percent in 1998).

Figure 5a. Energy-Producing Activities, Output Share

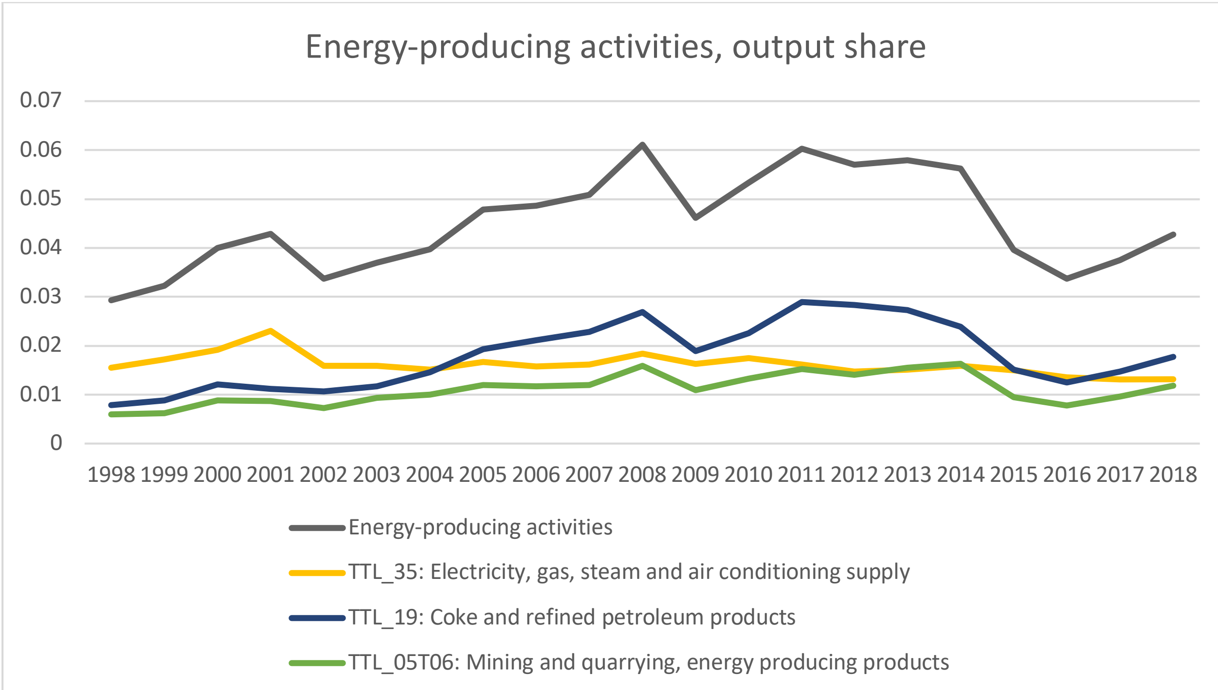


Figure 5b. Energy-Producing Activities, Employment Multipliers;

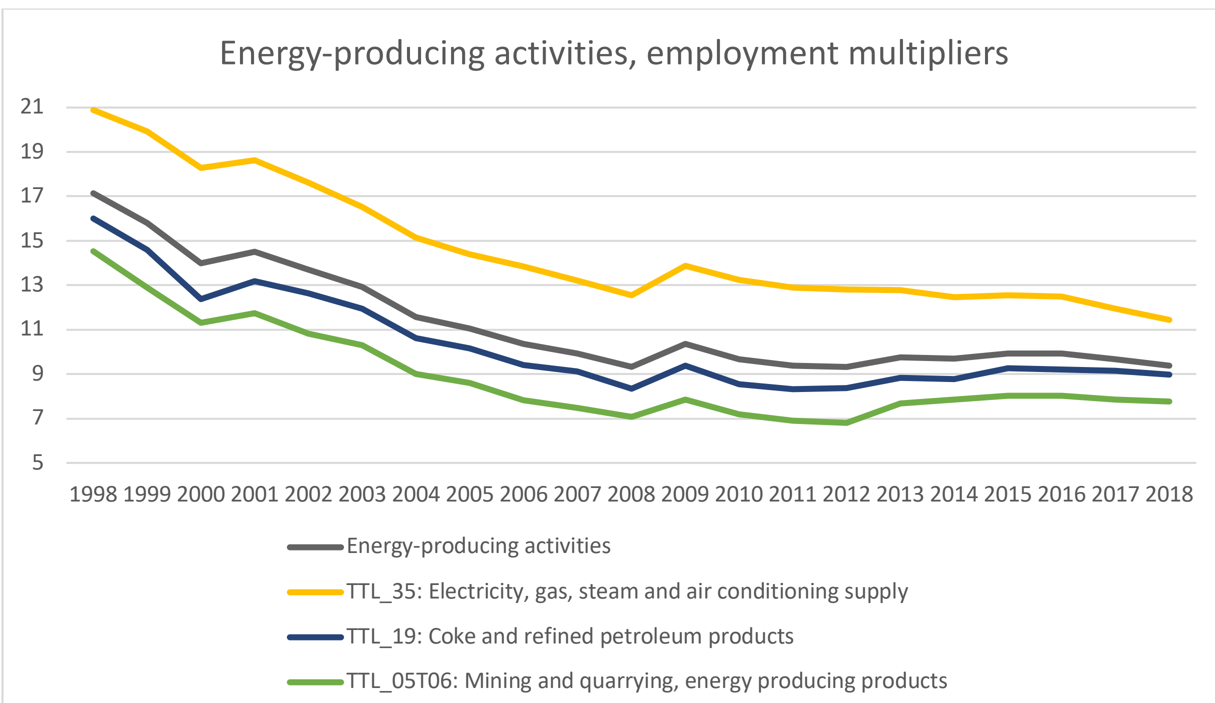


Figure 5c. Energy-Producing Activities, Trade Balance

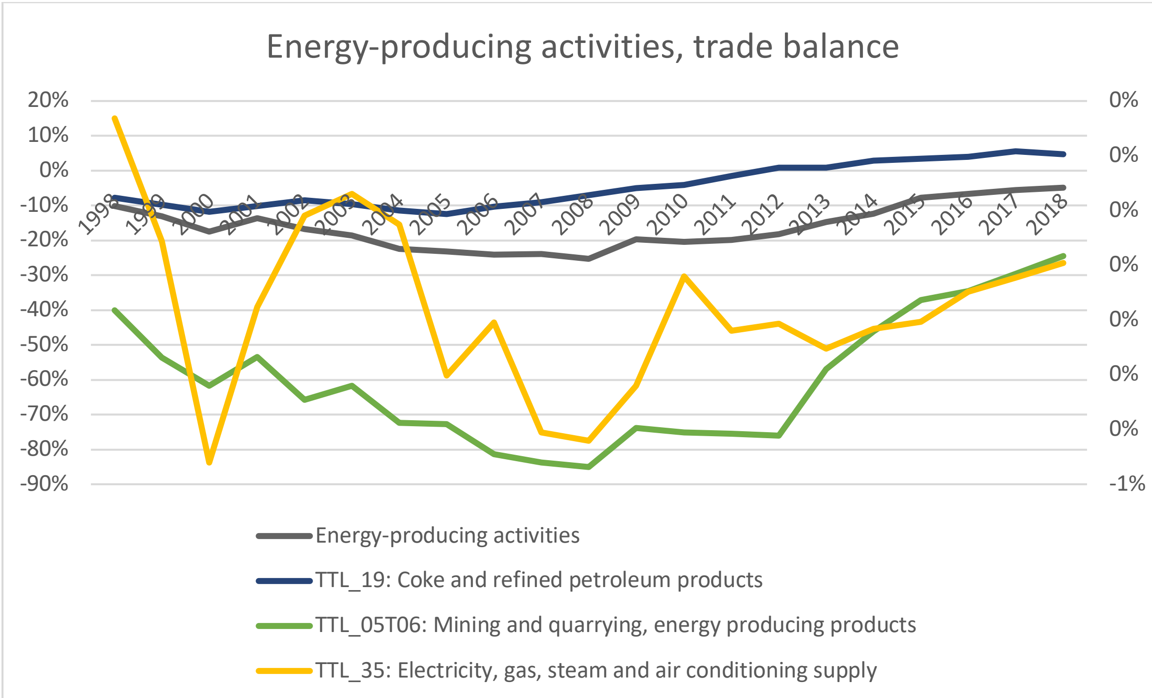


Figure 5d. Energy-Producing Activities, Import Multipliers

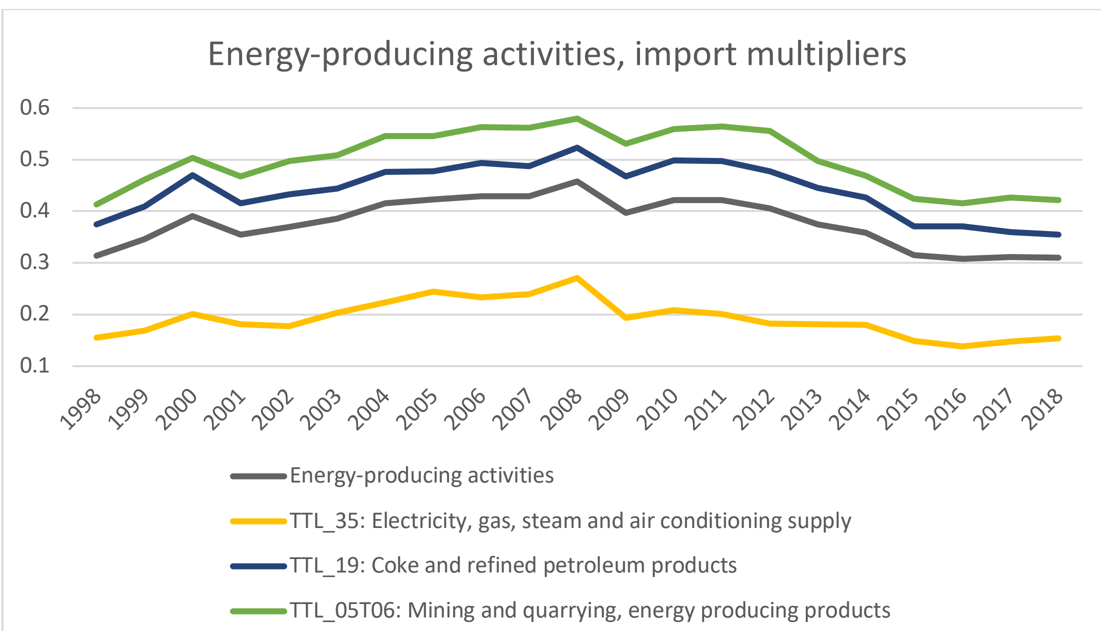
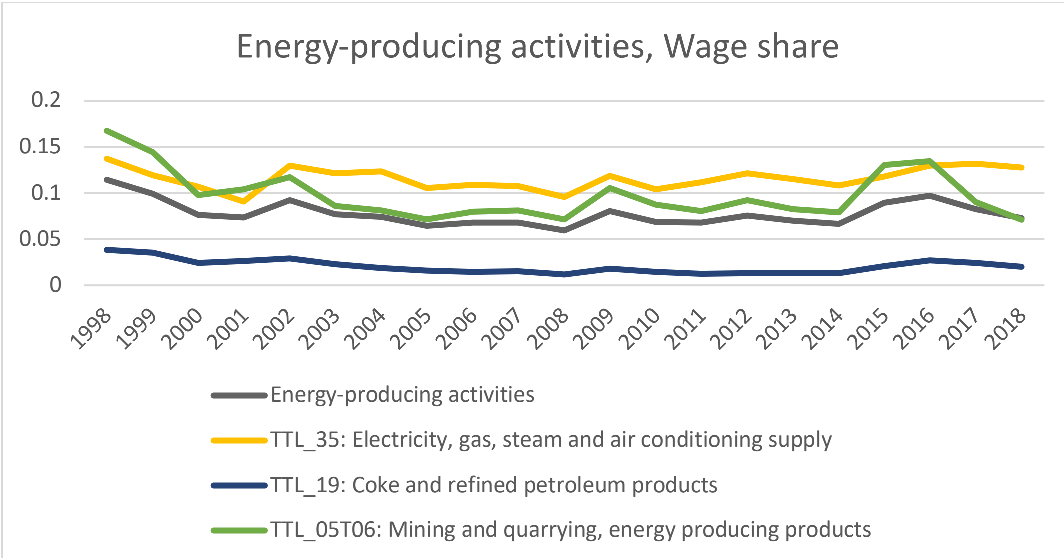


Figure 5e. Energy-Producing Activities, Wage Share



Fifth Process: The Demise of Wage Share

Another evident feature of the US economy is the reduction of wage participation on GDP in some sectors (see Figure 6). It should be noted that we are adopting a narrow definition of labor compensation with respect to the US Census Bureau (2023) and Mendieta-Muñoz et al. (2021). This explains why the trend is less evident at the US level, as well as at the macro-sectoral level, with both primary and secondary industries displaying a constant trend at 15 and 20 percent respectively and the tertiary ones showing a slight negative tendency (32 percent to 9 percent). A slightly different picture emerges when looking at the manufacturing sector in its different definitions. For instance, for machinery and equipment averaging 20 percent, the material manufacturing wage shares have contracted to 13 from 17 percent as other manufacturing has settled at a 19-percent level. If we instead look at the Pavitt definitions, we note how R&D intensive sectors (science-based and specialized suppliers) have managed to maintain a constant share of wages on GDP, while more rigid sectors in terms of innovation capabilities (suppliers-dominated and scale- and information-intensive) have experienced a contraction. If we take into account the innovative sectors singularly, the computers sector stands out as a remarkable outlier with the compensation share jumping from 20 to 33 percent in two decades, in stark contrast with a stagnating share in motor vehicles at 10 percent and a decrease in pharmaceuticals to 12 from 23 percent at the dawn of the twenty-first century.

Figure 6a. Wage Shares: Productive Sectors

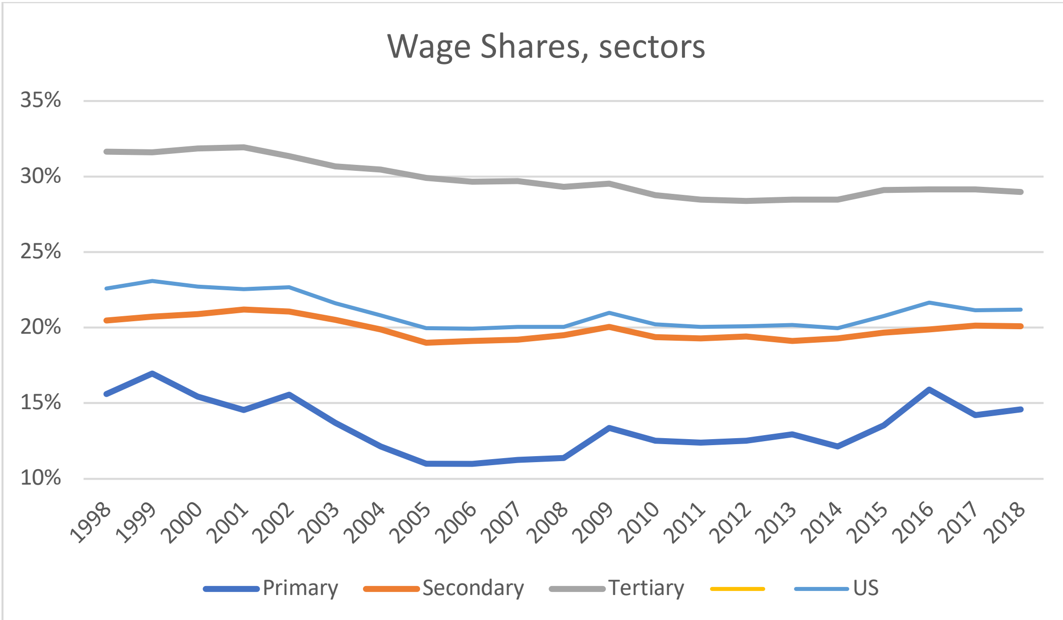


Figure 6b. Wage Shares: Activities by Pavitt

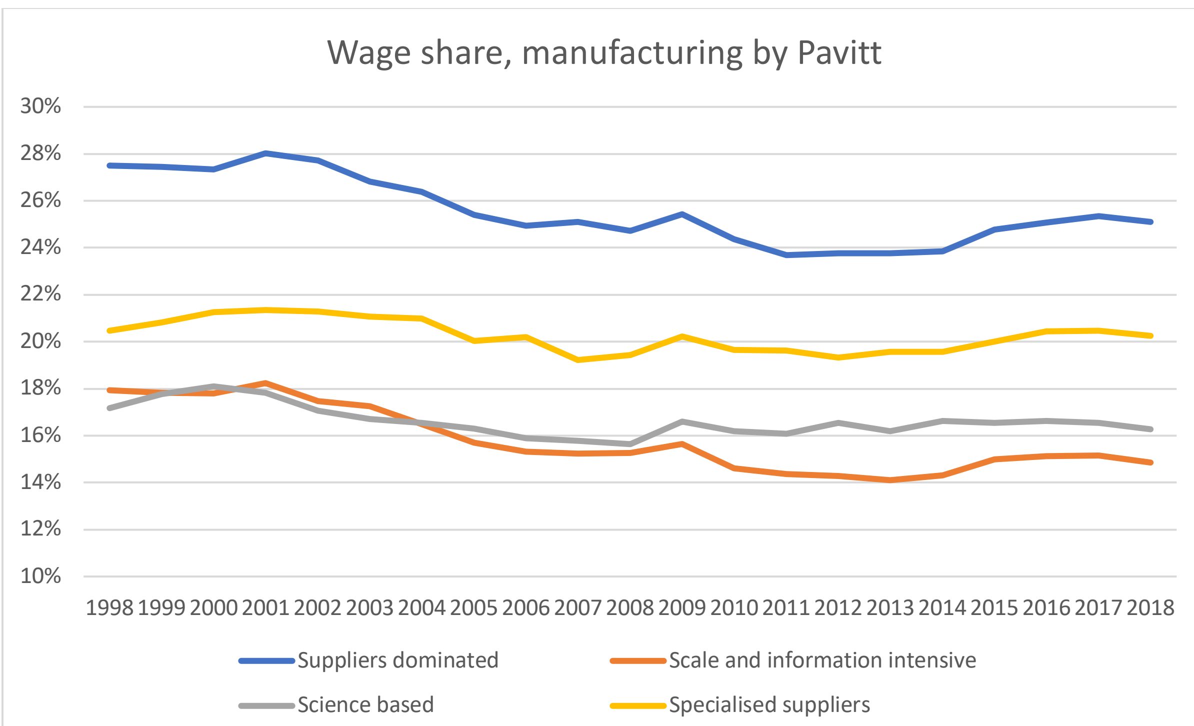


Figure 6c. Wage Shares: Manufacturing by Tech

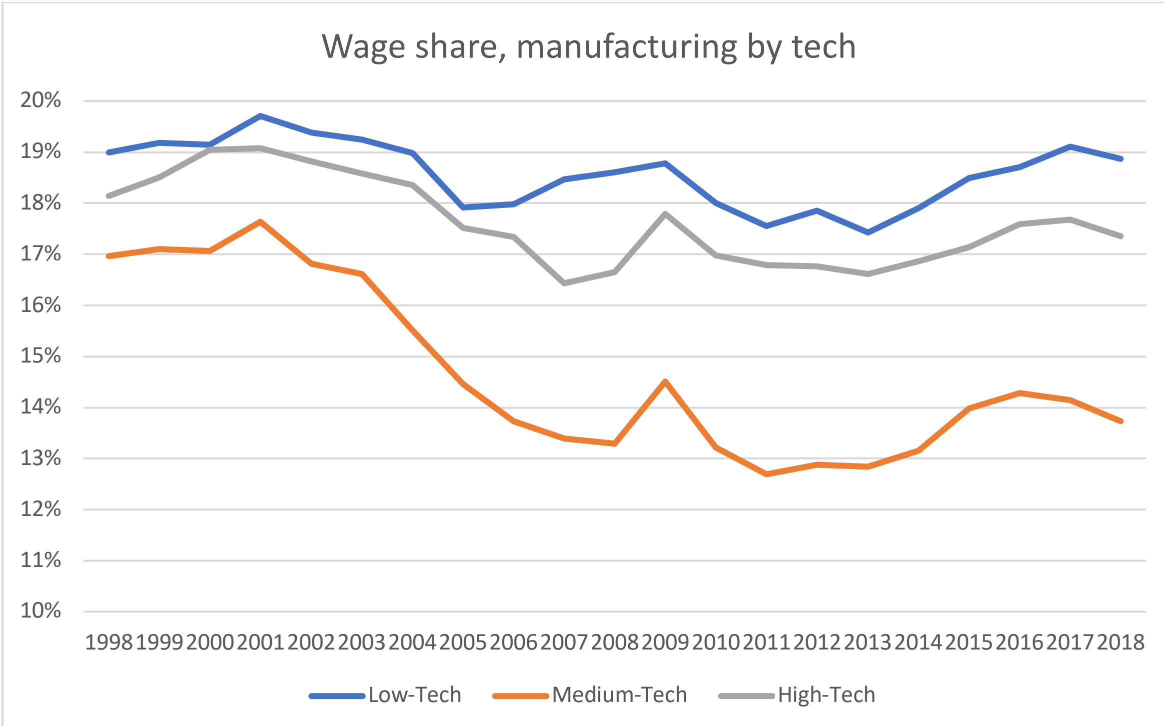


Figure 6d. Wage Shares: Manufacturing

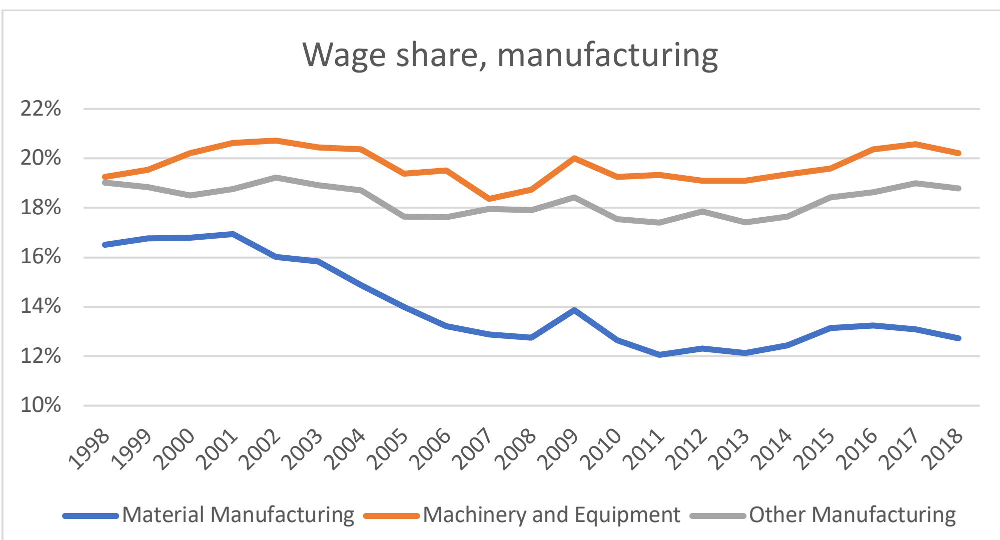


Figure 6e. Wage Shares: Machinery and Equipment

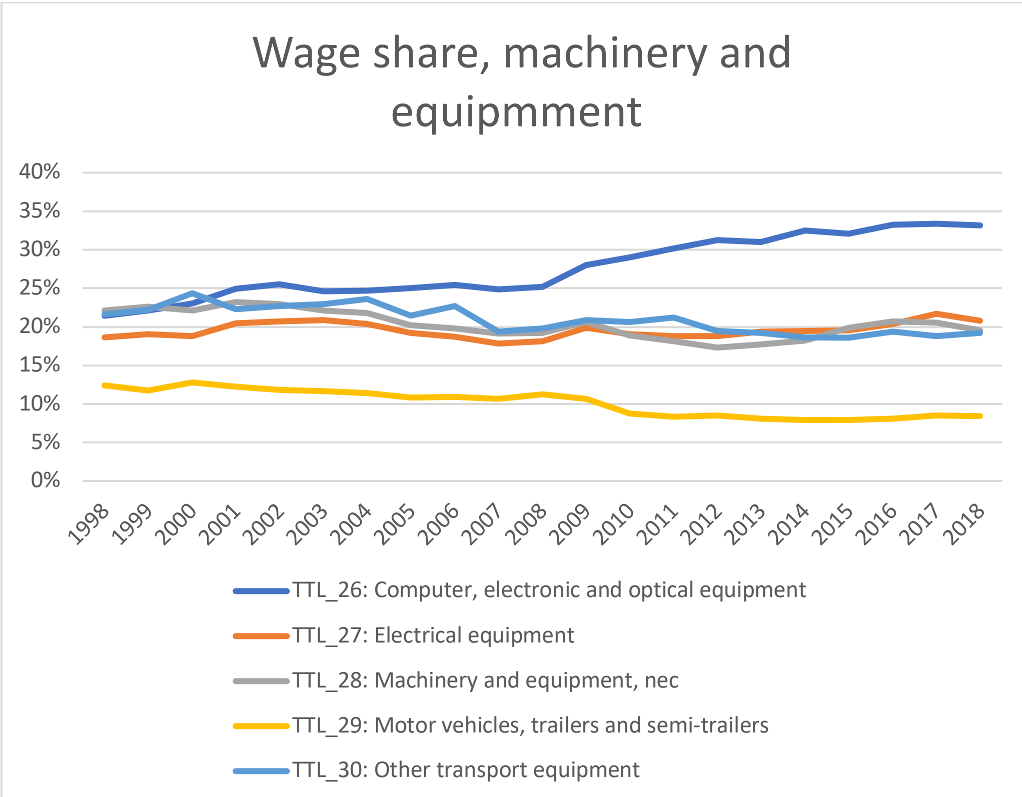


Figure 6f. Wage Shares: HT Manufacturing

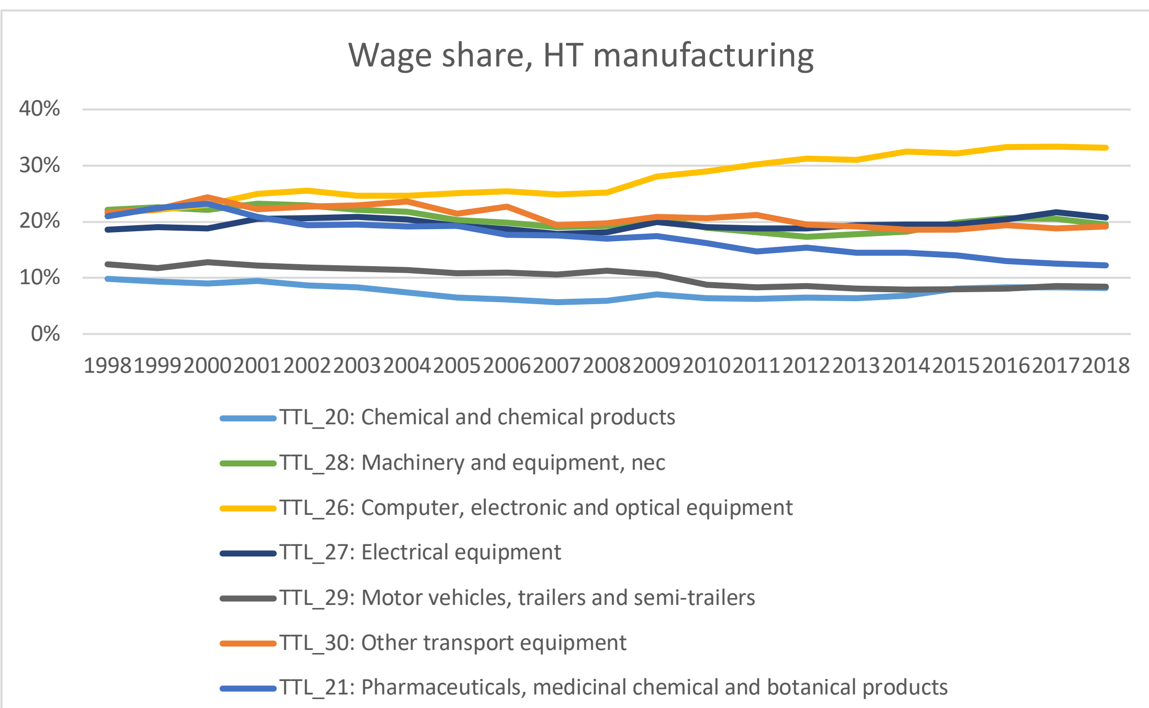
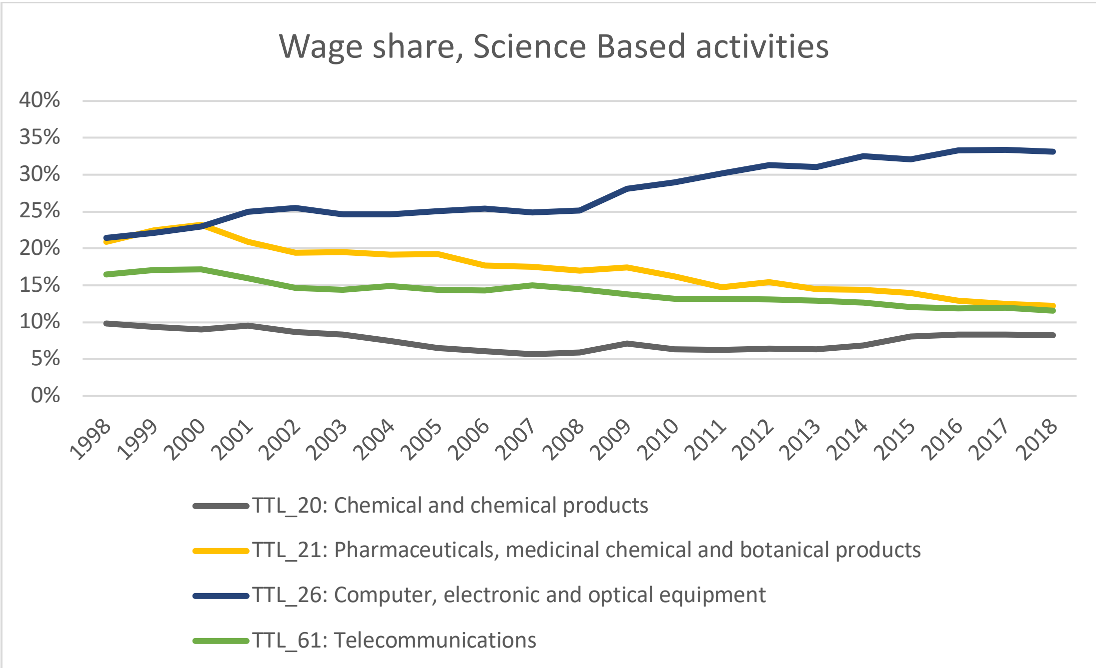


Figure 6g. Wage Shares: Science-Based Activities



Sixth Process: Structural Changes in Consumption Out of Wages

A structural shift has also taken place in the composition of the consumption basket of wage earners (see Figure 7)—in particular with respect to the consumption of manufacturing products, with material manufacturing having reduced its participation to 6 from 8 percent, as distributive services have also reduced their share to 16 from 18 percent.

Figure 7a. Composition of the Consumption Basket of Wage Earners

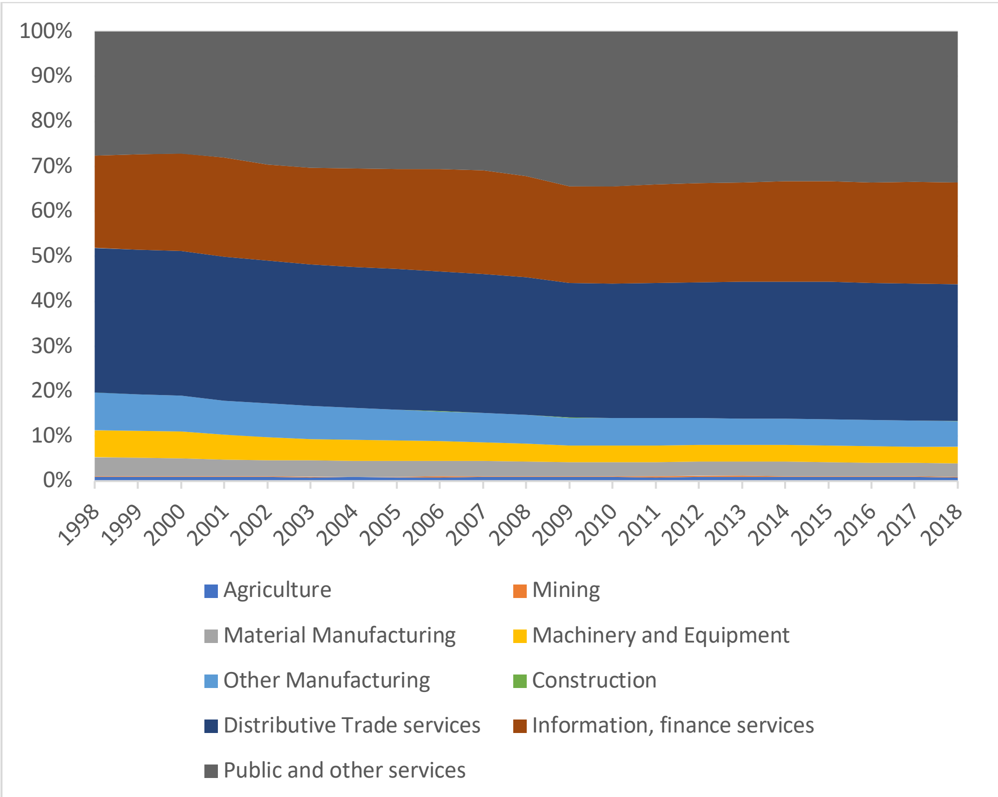


Figure 7b. Consumption Wage Share: Basic Industries

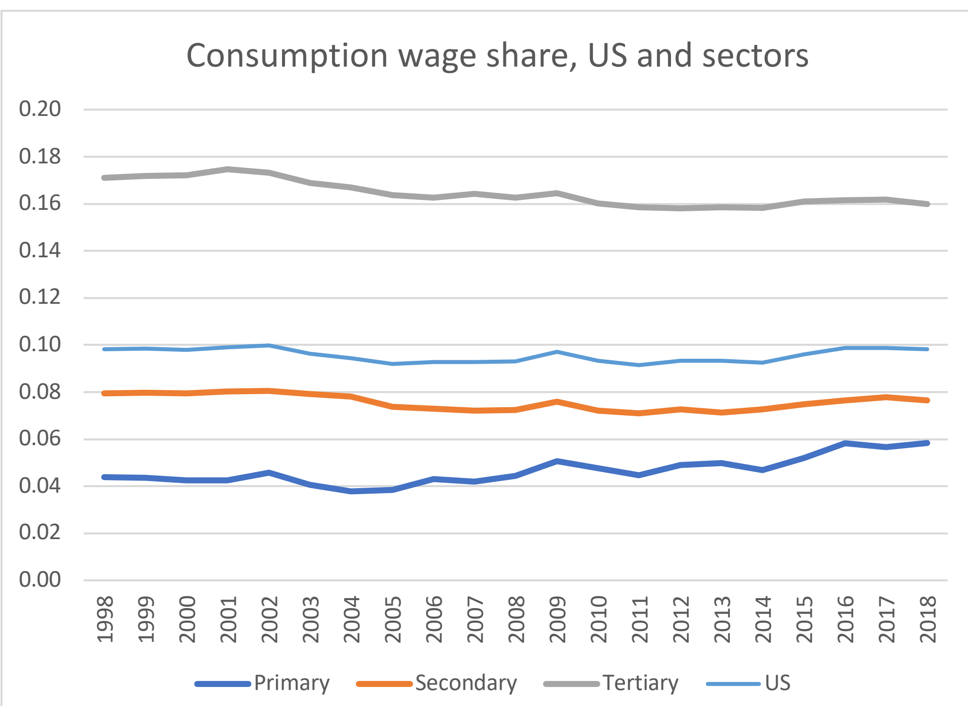


Figure 7c. Consumption Wage Share: Manufacturing

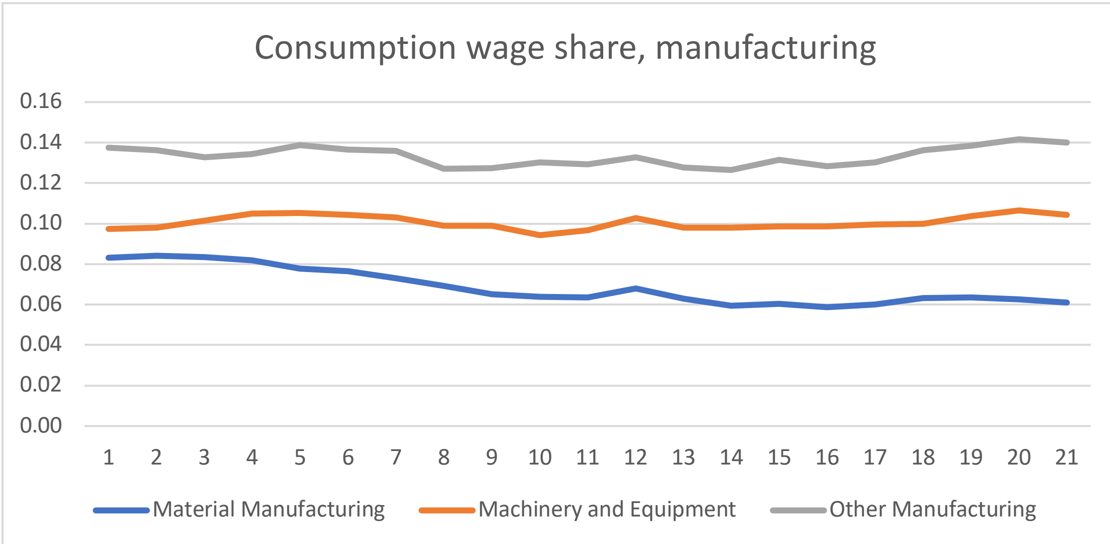


Figure 7d. Consumption Wage Share: Manufacturing by Tech

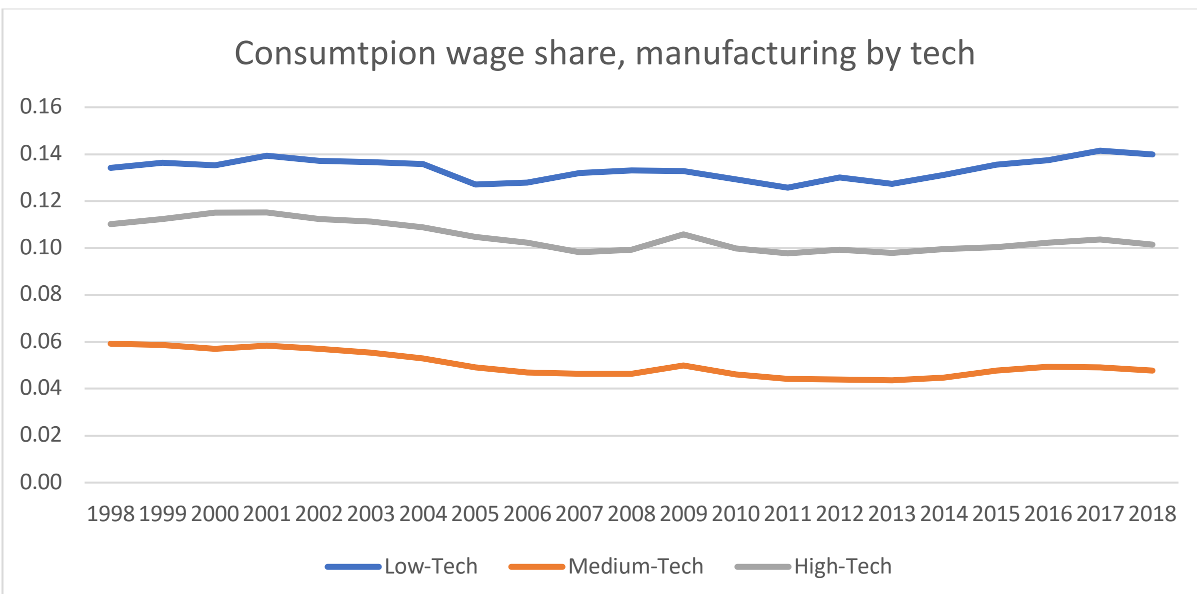


Figure 7e. Consumption Wage Share: Activities by Pavitt

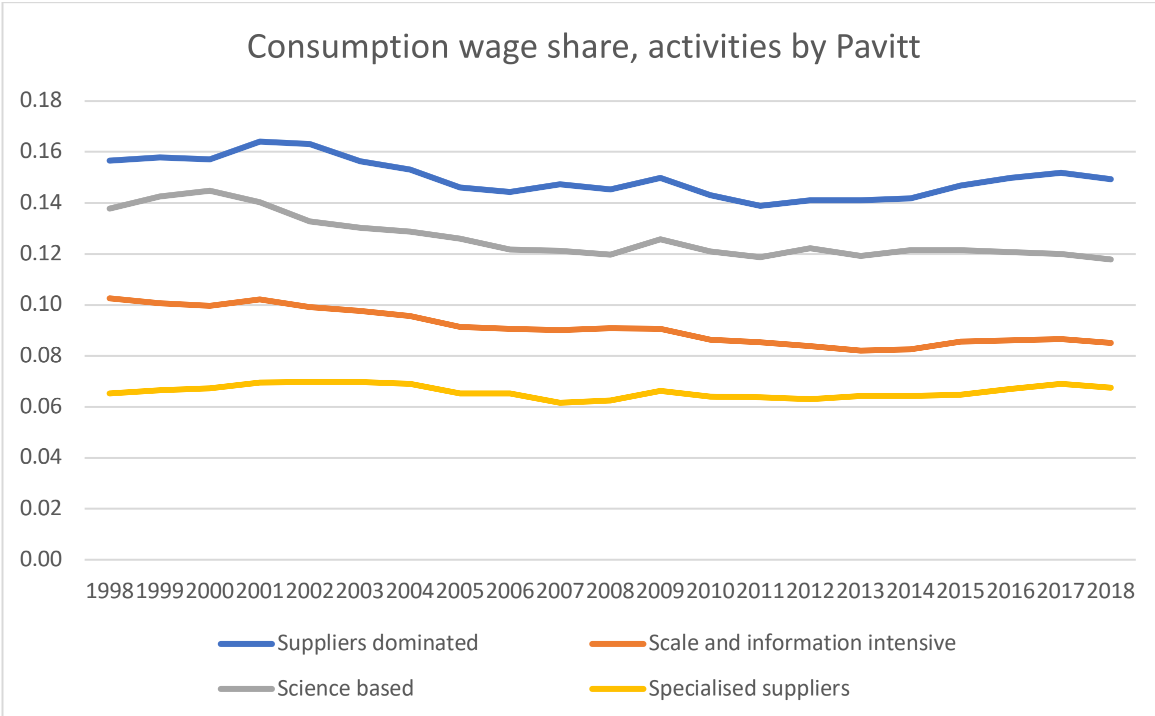


Figure 7f. Consumption Wage Share: Machinery and Equipment

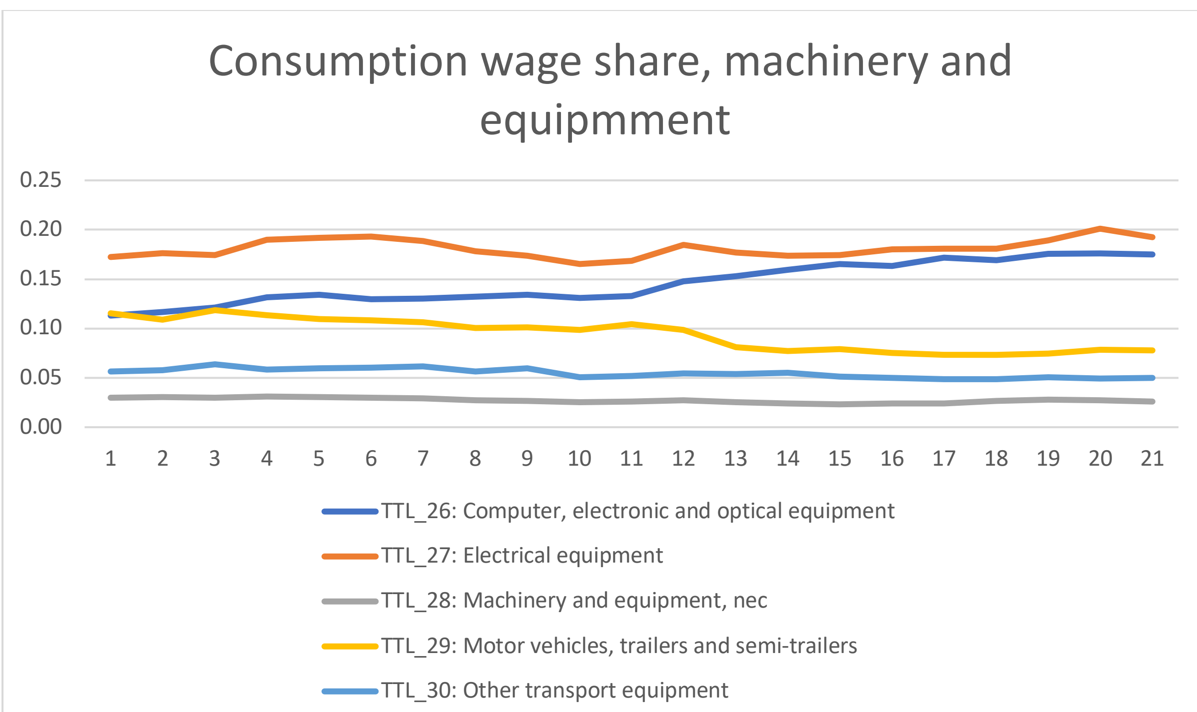


Figure 7g. Consumption Wage Share: HT Manufacturing

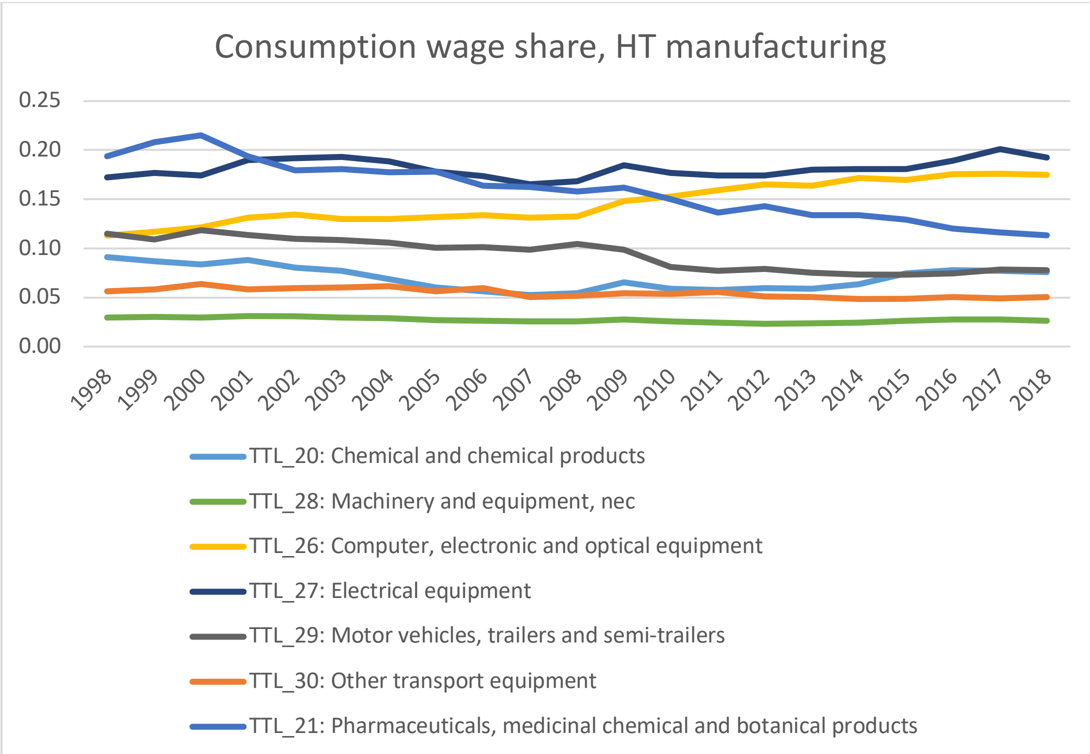
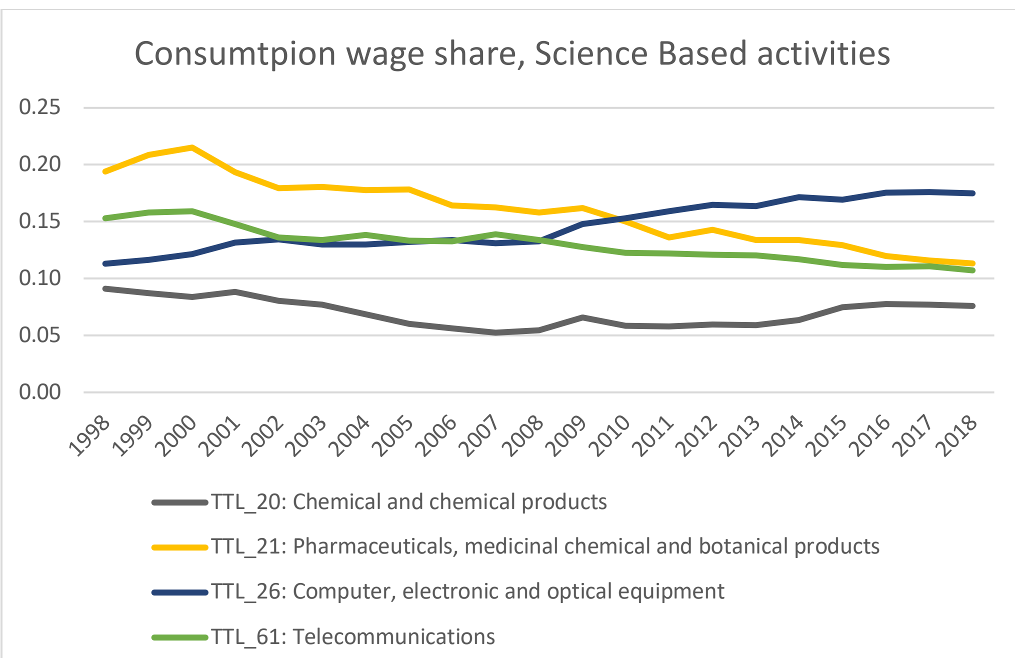


Figure 7h. Consumption Wage Share: Science-Based Activities



Seventh Process: The Demise of Employment Creation

Figure 8a. Employment Multipliers: Basic Sectors

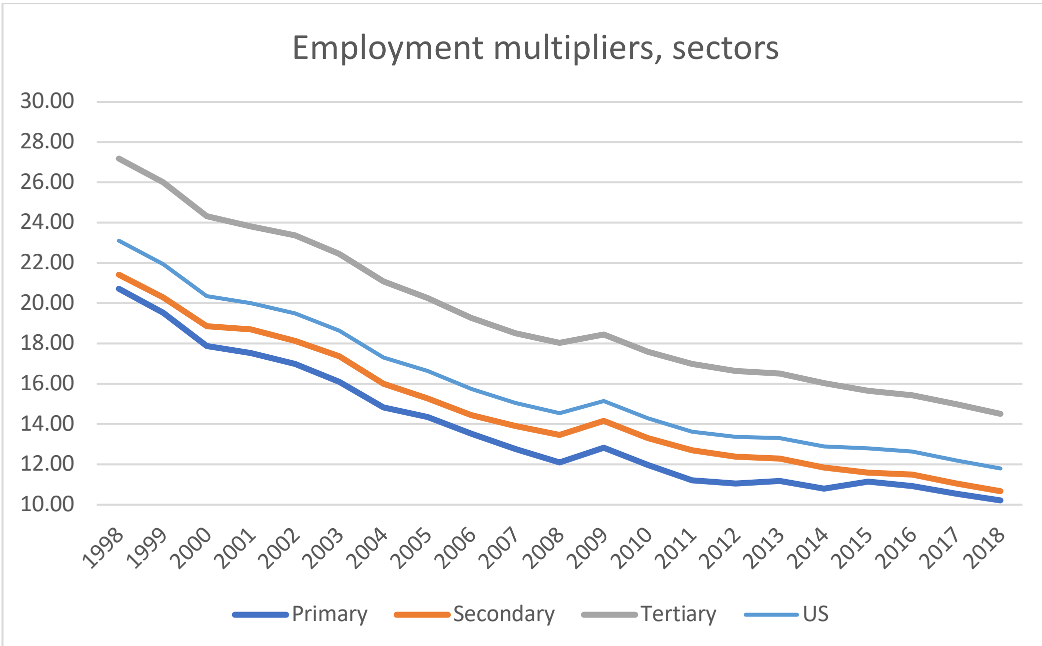


Figure 8b. Employment Multipliers: Manufacturing

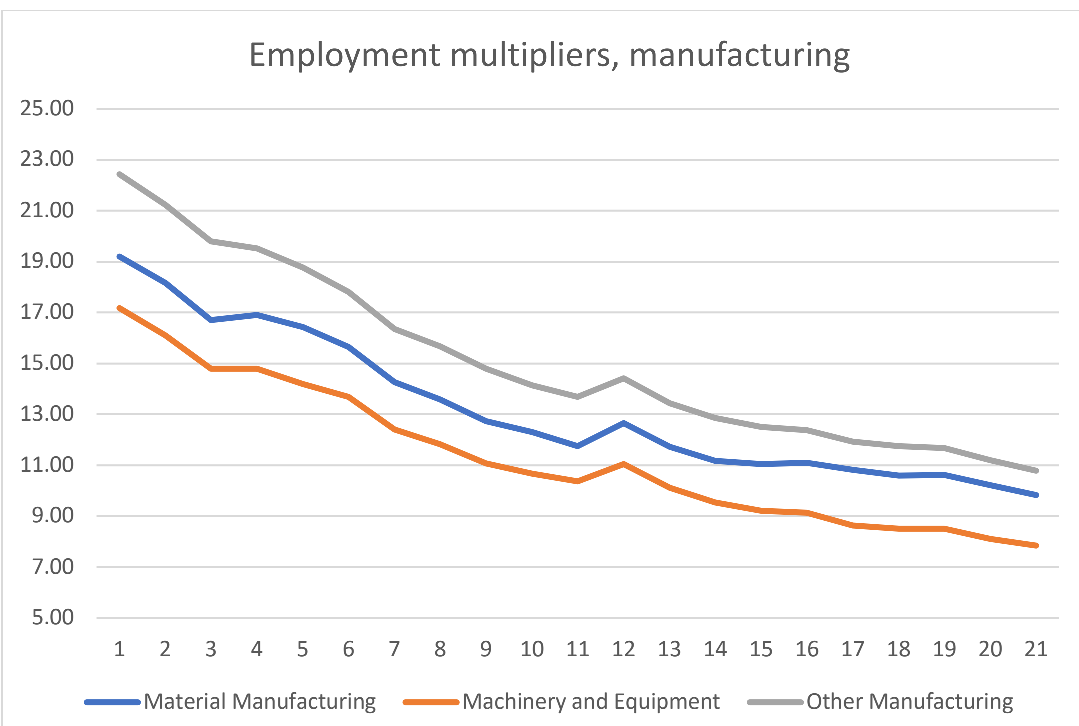


Figure 8c. Employment Multipliers: Manufacturing by Tech

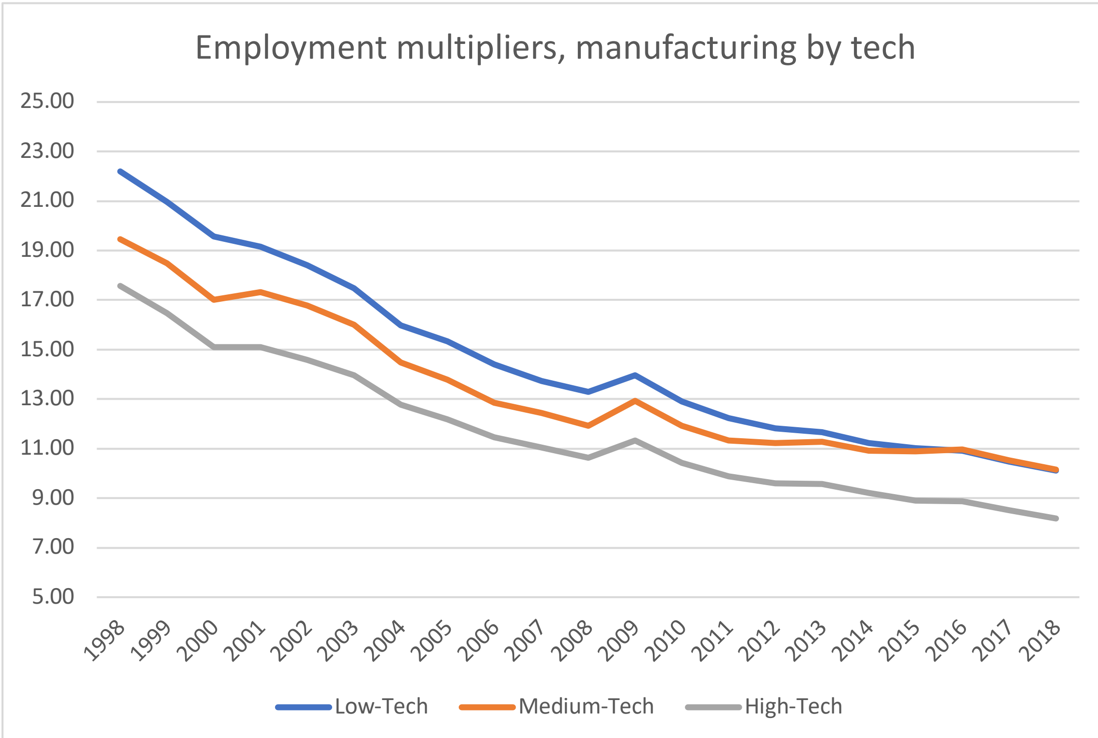


Figure 8d. Employment Multipliers: Activities by Pavitt

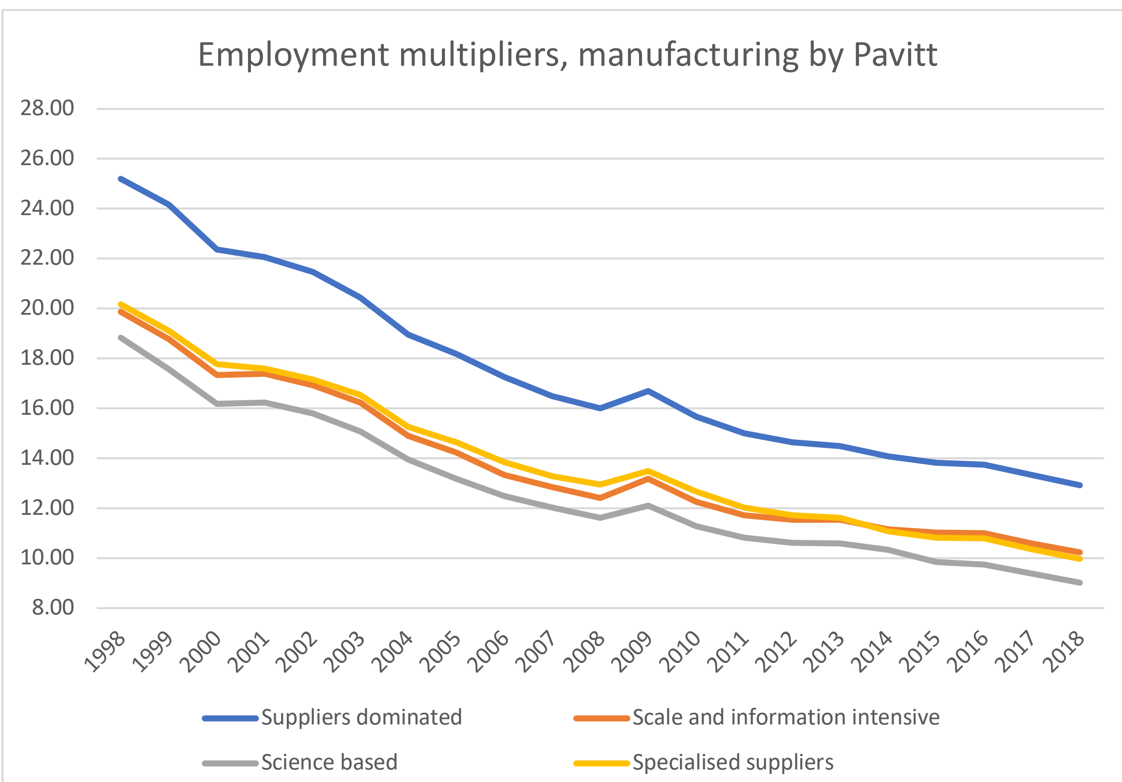


Figure 8e: Employment Multipliers: Machinery and Equipment

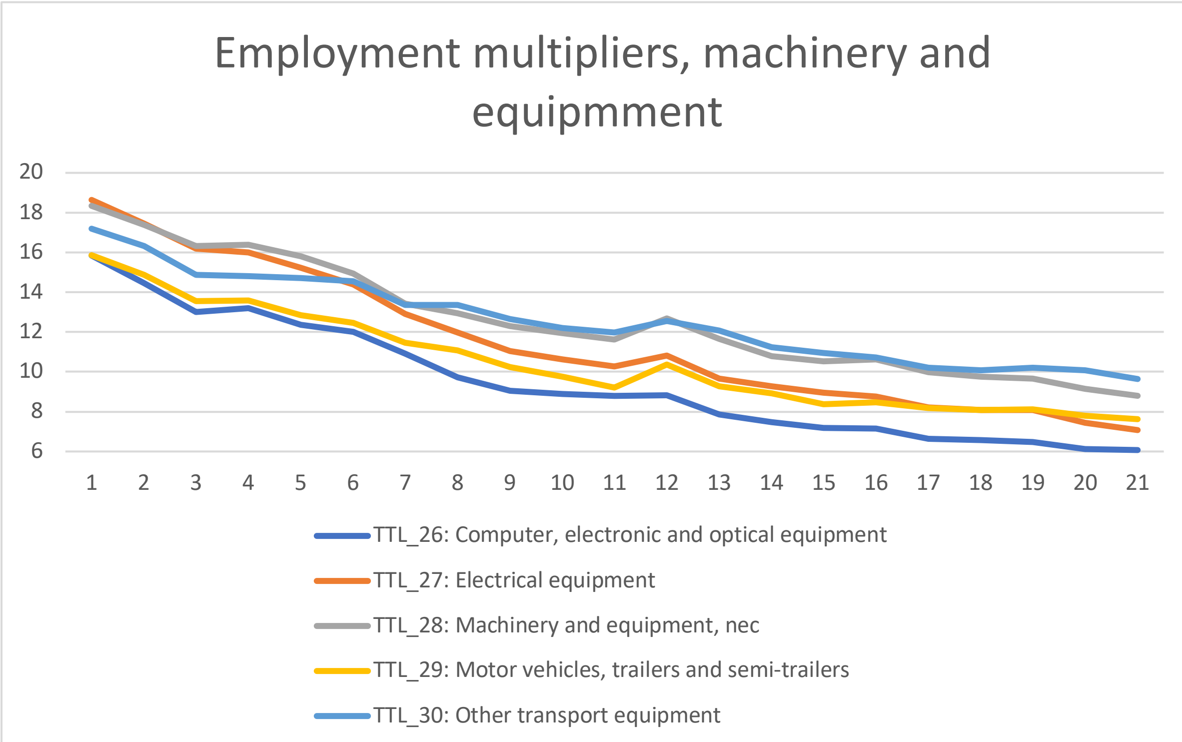


Figure 8f. Employment Multipliers: HT Manufacturing

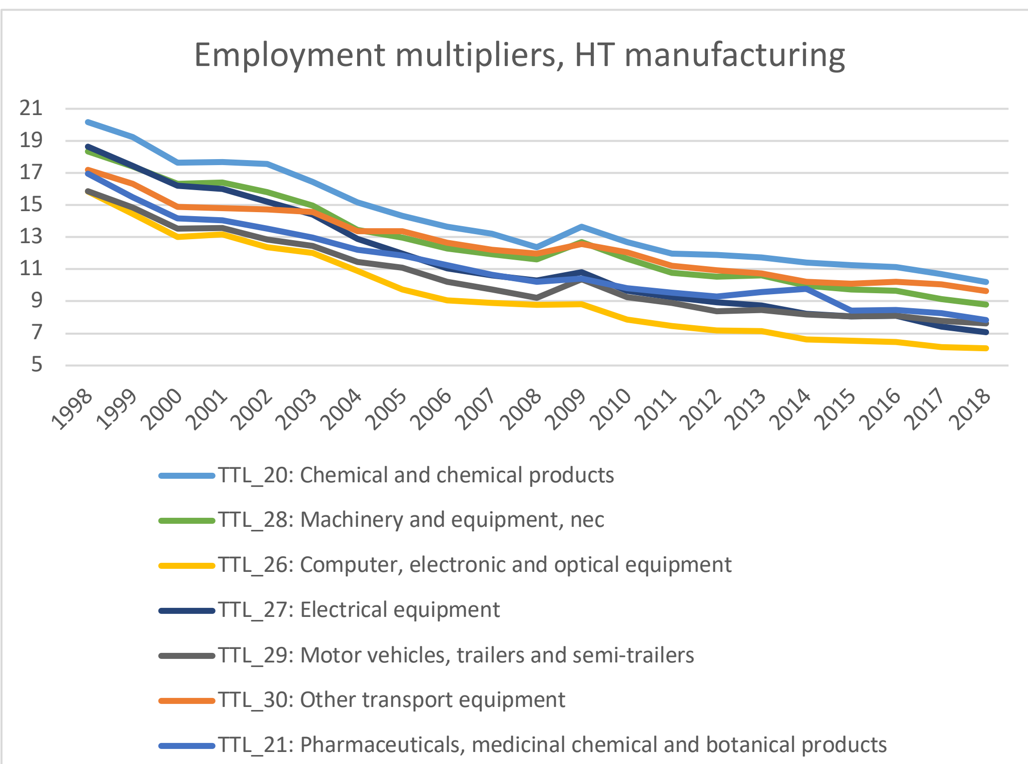
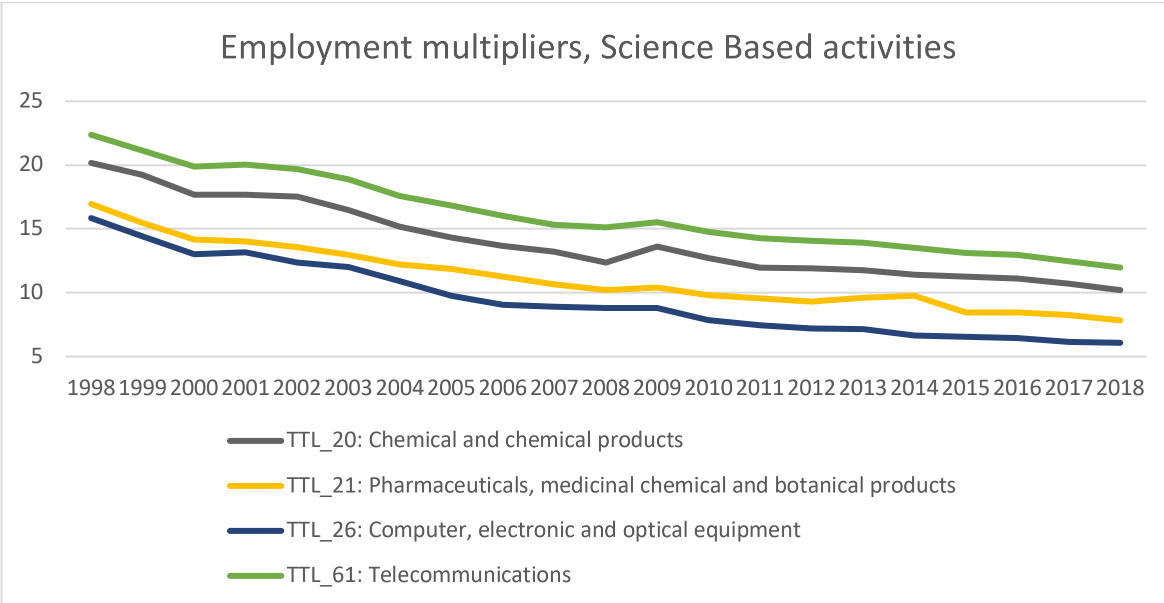


Figure 8g. Employment Multipliers; Science Based Activities



The final process we analyze regards the drop of the employment creation capacity by the US economy and its sectors. The country-wise employment multiplier has more than halved, a trend shared by the primary, secondary and tertiary sectors. Manufacturing industries have followed this trend too, although the contraction has been less evident for material and medium-tech manufacturing after 2008. Science-based, scale and information activities, and specialized suppliers have also contracted at a similar pace, with suppliers-dominated managing to reduce this pace at least for the post-GFC decade. As for the specific innovative sectors, such as computers, chemicals, and pharmaceuticals, they have halved their employment multipliers.

SOME ECONOMETRICAL EVIDENCE

Rodrik (2016) assesses the expected level of manufacturing development (as captured by three indicators: the share of manufacturing employment over total employment and the manufacturing GDP share both at constant and current values) according to the level of development of an economy through a panel data analysis. He uses the following regression: $va^*{}_{it} = \alpha + \beta_i + \gamma y_{it} + \delta y_{it}^2 + \theta pop_{it} + \mu pop_{it}^2 + \varepsilon_{it}$, where va is the manufacturing share, y

is the level of GDP per capita, and *pop* is the level of the population. By applying this regression to our time period, we can the estimate the expected level of development in the sector of interest.

Table 1. Modified Rodrik Equation

VARIABLES	(1) Value added share of Industry
Employment	0.000623***
	(3.04e-05)
Employment, Squared	-1.05e-08***
	(1.55e-09)
Productivity	0.00111***
	(0.000154)
Productivity, Squared	-9.79e-08***
	(1.58e-08)
Energy-producing dummy	-0.689***
	(0.232)
Consmuption basket dummy	-0.120***
	(0.0321)
Constant	0.262***
	(0.0742)
Observations	924
Number of code	44
R-squared	0.627

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In the regression reported above, we depart from Rodrik (2016) as we didn't include time dummies to capture the slope of the de-industrialization pattern of the industry value-added share. We instead follow Botta, Yajima, and Porcile (2023) as we rely on dummies constructed on economic variables. In particular, we use an energy-producing dummy to tag energy mining, petroleum, and electricity. Moreover, we also employ a dummy identifying periods and sectors in which the consumption shares fall below median value for the whole US economy. Using the fitted values of the value-added share of industries obtained with this procedure, we measure the impact of the "expected" level of the manufacturing development (the one we would expect given the general level of economic development) on the trade balance share on GDP and other controls. More specifically, running the following regression:

$$\widetilde{td}_{i,t} = \alpha + \beta va^{*}{}_{i,t} + \gamma x_{i,t} + \delta D^{f}_{i,t} + \varepsilon_{i,t}$$

In this regression, $\widetilde{td}_{i,t}$ is the sectoral trade share on GDP, i.e., our measure of premature de-industrialization, and $va^{*}{}_{i,t}$ is the predicted value-added share of manufacturing as defined above. $x_{i,t}$ is a vector of continuous variable controls and $D^{f}_{i,t}$ denotes a vector of discrete (dummy) variables and interaction terms. More specifically, among the first set of variables we find the import and employment multipliers, the wage share and the profit rate, whereas, among the second set we included a dummy for the more technologically advanced subsectors and an interaction term between this last binary variable and the wage share. This econometrical level has been run for four different sets of sectors, namely for a) secondary industries, b) manufacturing industries by categories, c) manufacturing industries by technology, and d) industries identified by Pavitt taxonomy.

Table 2. Secondary Sector

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	M1	M2	M3	M4	M5	M6
Predicted Value added share of Industry	4.557***	4.861***	3.495***	3.554***	3.285***	3.032***
	(1.278)	(1.344)	(1.015)	(0.910)	(0.963)	(0.791)
Import Multipliers	-1.197***	-1.185***	-1.377***	-1.671***	-1.668***	-1.875***
	(0.132)	(0.180)	(0.171)	(0.182)	(0.185)	(0.173)
Employment Multipliers		-0.0844	-0.112	-0.211	-0.347	-0.419
		(0.441)	(0.404)	(0.422)	(0.421)	(0.408)
Wage Share			-1.202***	-1.429***	-1.251***	-1.620***

			(0.178)	(0.160)	(0.169)	(0.169)
Machinery and Equipment Sector				21.69***	20.64***	
				(2.377)	(2.638)	
Profit Rate					-0.0718***	-0.0864***
					(0.0134)	(0.0157)
1.machequp_code#c.ws						1.190***
						(0.131)
Constant	18.87***	19.22*	49.04***	58.60***	61.13***	75.84***
	(4.896)	(11.28)	(11.26)	(11.49)	(11.76)	(11.04)
Observations	420	420	420	420	420	420
R-squared	0.357	0.342	0.453	0.564	0.539	0.621
Number of code	20	20	20	20	20	20

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3. Manufacturing Sector, by Category

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	M1	M2	M3	M4	M5	M6
Predicted Value added share of Industry	13.59***	12.47***	8.527***	9.622***	9.044***	7.916***
	(2.806)	(2.789)	(2.365)	(2.217)	(2.178)	(2.095)
Import Multipliers	-1.324***	-1.226***	-1.388***	-1.715***	-1.848***	-1.793***
	(0.145)	(0.188)	(0.180)	(0.189)	(0.189)	(0.186)
Employment Multipliers		0.0458	-0.0312	-0.160	-0.404	-0.306
		(0.464)	(0.432)	(0.448)	(0.450)	(0.439)
Wage Share			-1.033***	-1.210***	-1.092***	-1.398***
			(0.186)	(0.156)	(0.153)	(0.183)
Machinery and Equipment Sector				20.53***	20.75***	
				(2.281)	(2.357)	
Profit Rate					-0.0728***	-0.0774***
					(0.0143)	(0.0153)

1.machequp_code#c.ws						1.066***
						(0.134)
Constant	14.18***	11.39	40.25***	49.54***	59.27***	62.72***
	(4.949)	(11.57)	(11.66)	(11.46)	(11.50)	(11.55)
Observations	399	399	399	399	399	399
R-squared	0.393	0.358	0.450	0.573	0.593	0.585
Number of code	19	19	19	19	19	19

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4. Manufacturing Sector, by Tech

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	M1	M2	M3	M4	M5	M6
Predicted Value added share of Industry	14.67***	12.94***	8.879***	8.992***	8.588***	8.517***
	(2.850)	(2.917)	(2.429)	(2.389)	(2.351)	(1.974)
Import Multipliers	-1.562***	-1.435***	-1.625***	-1.689***	-1.734***	-2.068***
	(0.158)	(0.219)	(0.208)	(0.214)	(0.207)	(0.198)
Employment Multipliers		-0.137	-0.259	-0.175	-0.327	-0.548
		(0.531)	(0.503)	(0.506)	(0.487)	(0.472)
Wage Share			-1.072***	-1.111***	-0.987***	-1.389***
			(0.191)	(0.175)	(0.178)	(0.156)
High tech				14.52***	16.40***	
				(1.864)	(2.174)	
Profit Rate					-0.0925***	-0.125***
					(0.0163)	(0.0192)
1.ht_code#c.ws						1.121***
						(0.112)
Constant	21.85***	21.03	52.73***	48.45***	53.46***	75.50***
	(5.738)	(13.77)	(13.60)	(13.69)	(13.31)	(12.37)
Observations	357	357	357	357	357	357
R-squared	0.459	0.397	0.494	0.540	0.544	0.661

Number of code	17	17	17	17	17	17

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5. Pavitt Categories

VARIABLES	(1) M1	(2) M2	(3) M3	(4) M4	(5) M5	(6) M6
Predicted Value added share of Industry	-0.343	-0.308	-0.308	0.308	0.254	0.313
	(0.522)	(0.521)	(0.521)	(0.454)	(0.433)	(0.449)
Import Multipliers	-1.115***	-1.190***	-1.190***	-1.348***	-1.470***	-1.470***
	(0.122)	(0.147)	(0.147)	(0.134)	(0.132)	(0.134)
Employment Multipliers		-0.275	-0.275	-0.114	-0.181	-0.130
		(0.283)	(0.283)	(0.254)	(0.239)	(0.242)
Wage Share				-0.744***	-0.718***	-0.854***
				(0.117)	(0.109)	(0.121)
Science based				4.280***	7.423***	
				(1.166)	(1.291)	
Profit Rate					-0.0818***	-0.0763***
					(0.0114)	(0.0106)
1.scbased_code#c.ws						0.391***
						(0.0679)
Constant	21.47***	27.73***	27.73***	42.46***	50.16***	51.77***
	(4.380)	(7.681)	(7.681)	(7.372)	(7.350)	(7.328)
Observations	609	609	609	609	609	609
R-squared	0.366	0.364	0.364	0.462	0.501	0.501
Number of code	29	29	29	29	29	29

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

CONCLUSIONS

The analysis of the US trade and industry sector reveals several unsustainable processes that warrant further examination and targeted interventions. These processes include a deterioration in the trade balance, an increase in import multipliers, a decline in the manufacturing share of GDP, a rise in the commodities share of GDP, a decrease in the wage share, structural shifts in the consumption patterns, and a decline in employment multipliers.

The first process, the trade deterioration in high-tech (HT) industries, demonstrates a significant trade deficit in machinery and equipment, as well as other manufacturing activities. This points to a loss of competitiveness and a reliance on imported goods in these sectors. To address this, the US should focus on enhancing its domestic production capabilities and promoting innovation in HT industries to reduce import dependency and improve trade balance.

The second process, the rise in import multipliers in HT industries, indicates a growing dependence on imported inputs. This has implications for the domestic supply chain and for value-added activities. To mitigate this, efforts should be made to strengthen domestic sourcing and production capacities, promote local procurement, and reduce reliance on imported inputs, particularly in machinery and equipment manufacturing.

The third process, the drop in the manufacturing share of GDP, highlights the de-industrialization trend in the US economy. While primary industries have maintained a steady share, the decline in manufacturing activities, especially in machinery and equipment, raises concerns about the erosion of the manufacturing base. It is crucial to implement policies which support and incentivize domestic manufacturing, foster innovation, and enhance the competitiveness of the manufacturing sector.

The fourth process, the rise in commodities share of GDP, emphasizes the increasing importance of the energy sector, particularly in coke and refined petroleum products. While this specialization has shown some positive outcomes in terms of trade balance improvement, it also raises concerns about resource dependency and environmental sustainability. The US should strive for a balanced approach, diversifying its energy sources, investing in renewable energy, and implementing policies that promote sustainable resource extraction and energy practices.

The fifth process, the demise of the wage share, indicates a reduction in the share of wages in certain sectors, particularly in material manufacturing and other manufacturing activities. This trend raises questions about income inequality and the distribution of economic gains. It is essential to pursue policies that promote fair wages, support workers' rights, and ensure a more equitable distribution of income within the economy.

The sixth process, the structural changes in consumption from wages, suggests a shift in the consumption patterns of wage earners, with a reduced share allocated to manufacturing products. This highlights the need to encourage domestic consumption of domestically produced goods, support local industries, and promote sustainable and responsible consumption practices.

The seventh process, the decline in employment creation, reflects a decrease in the employment multipliers, particularly in the manufacturing sector. This poses challenges for job creation and economic growth. To address this, the US should prioritize policies that promote job growth, enhance skills training and education, and support the development of industries with high employment multipliers, such as HT manufacturing and renewable energy.

To sum up, a comprehensive approach is needed to address the unsustainable processes observed in the US trade and industry sector. This requires a focus on promoting domestic production, innovation, and investment in high-tech industries, renewable energy, and sustainable agriculture. Additionally, policy interventions should be implemented to address income inequality, promote equitable distribution of income and wealth, and mitigate the negative environmental impacts of resource extraction. By pursuing these strategies, the US can transition toward a more sustainable and value-added economy that ensures long-term economic prosperity and social well-being.

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