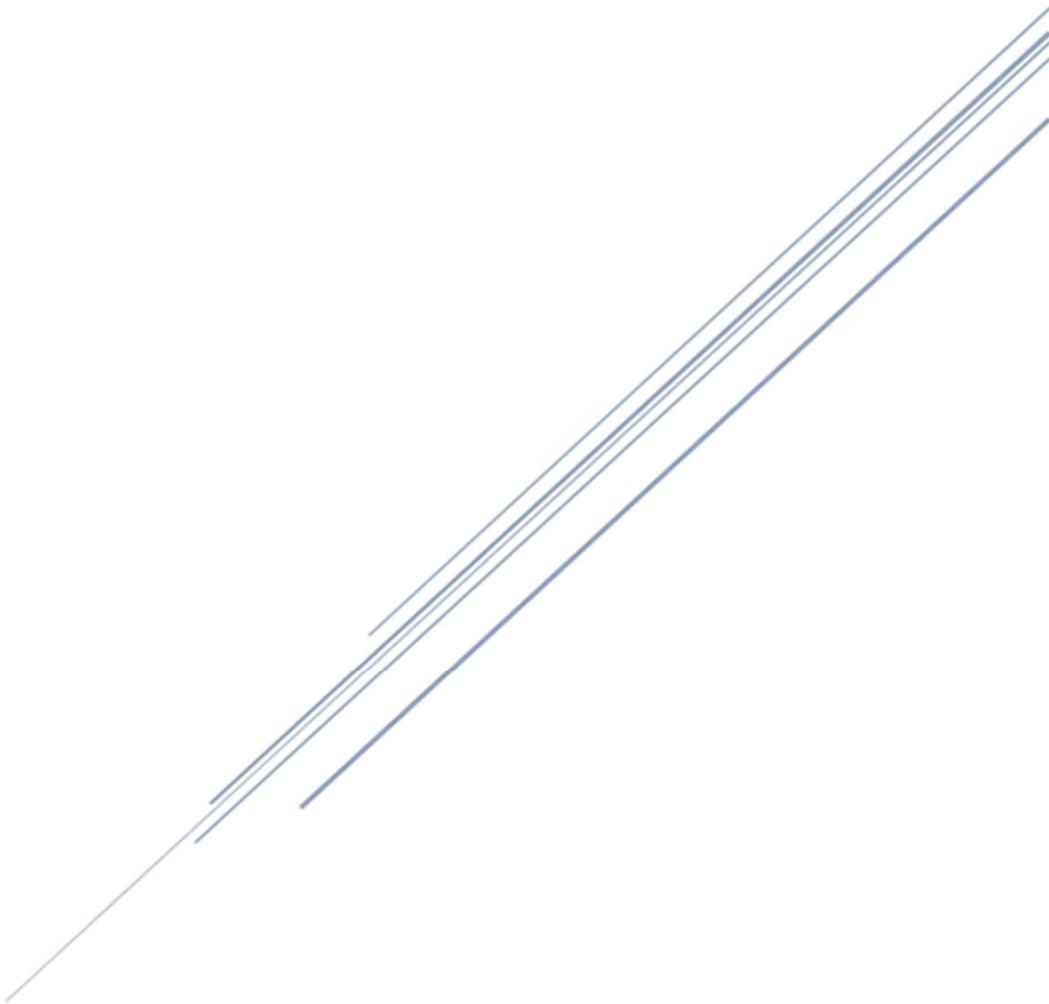


**BRAZIL AND THE INTERNATIONAL TRADE IN SEMICONDUCTORS: A FIRST
ASSESSMENT**



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Brazil and the international trade in semiconductors: A first assessment[∞]

1. Introduction.

It is well known that semiconductors design & production is concentrated in the US and Asia, together with specific European niches. But semiconductors are a world necessity and other countries should at least engage in their production nexus, even if not at the top edge or not aiming at an impossible self-sufficiency.

Flôres (2023)¹ pledges for greater attention to this issue in Brazil, where, given the country's trade channels, international trade could act both as an incentive and an at least modest fund provider for the needed developments. To support this point, a deeper knowledge of the international flows is however required.

This Brief is a first attempt at filling this gap. It does not intend to be a comprehensive international market analysis of how Brazil stands in the world chips' trade. However, it uncovers a few realities that support the view that more efforts are necessary to revert a present dependency that can become a serious shortcoming in a not-too-distant future.

UN Comtrade data are mostly used here; though they are not the ideal source for certain analyses, a first assessment through them is unavoidable.

The following section discusses classification issues and outlines how one could gauge the market, using trade data. The latter should be taken as a brief digression. Section 3 presents results up to 2022, divided into the lines of inquiry previously discussed. A final section concludes.

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¹ Combinando política industrial e comercial: semicondutores e o Brasil, R. G. Flôres Jr., *Revista Brasileira de Comércio Exterior*, Nº 157 - Outubro, Novembro e Dezembro de 2023, pgs.14-19.

2. Two points on methodology.

Classifications

The UN Comtrade databank uses the harmonised system HS-2017, with the available data going down to six digits. The BACI trade database, developed by CEPII (France) also contains import and export data under HS-2017 –conveniently elaborated for direct use- for 200 countries and 5.000 products, down to six-digit products.

Broadly, at Comtrade four-digits, the key sector for chips (“*Electronic integrated circuits*”) is in code 8542, which, at six-digits, unfolds into:

854231	<i>Electronic integrated circuits; processors and controllers, whether or not combined with memories, converters, logic circuits, amplifiers, clock and timing circuits, or other circuits</i>
854232	<i>Electronic integrated circuits; memories</i>
854233	<i>Electronic integrated circuits; amplifiers</i>
854239	<i>Electronic integrated circuits; n.e.c. in heading no. 8542</i>
854290	<i>Parts of electronic integrated circuits</i>

Apparently, the four first subgroups include the main chips, namely, memory and logic ones, amplifiers, and “a rest” that may also be of relevance. The last subgroup includes parts of circuits.

However, the suppliers’ and final users’ markets also present interest. This opens a Pandora’s Box of four- and six- digits products, usually grouped under four headings, Rabobank (2023)²:

wafer production,

semiconductor production itself,

² Mapping Global Supply Chains – The Case for Semiconductors, 14 June 2023, K. Ji, L. Nauta and J. Powell, Amsterdam: Cooperatieve Rabobank UA.

use of semiconductors in intermediate electronics (subdivided into intermediate industry and intermediate consumer),

final electronics incorporating semiconductors (subdivided into final industry and final consumer).

The six-digit products related to the groups above are many and varied. Exhibit 1 provides a glimpse on them, describing those associated to the ‘final consumer’ subdivision in the last group, excluding specific final uses like those in the car industry, for instance.

Exhibit 1: Final electronics incorporating semiconductors: final consumer products.

HS codes	Description
851712	Telephones for cellular networks or other wireless networks
851718	Telephone sets n.e.c. in item 8517.1
851770	Telephone sets and other apparatus for the transmission or reception of voice, images or other data, via a wired or wireless network; parts
85181	Microphones, stands, therefor
852580	Television cameras, digital cameras and video camera recorders
8528	Monitors and projectors, not incorporating television reception apparatus; reception apparatus for television, whether or not incorporating radio-broadcast receivers or sound or video recording or reproducing apparatus
9006	Photographic cameras, photographic flashlight apparatus and flashbulbs (excl. discharge lamps of heading 8539)
950450	Games, video game consoles and machines, other than those of subheading 9504.30

Source: Adapted from Appendix 2 in Rabobank (2023).

Moreover, in the Standard International Trade Classification – SITC, rev. 4³, five-digit (*subsidiary heading*) products, linked either to physical-use semiconductors or manufacturing inputs, are found. They are listed in Exhibit 2. The three first relate to inputs and the remaining ones to final goods.

Exhibit 2: SITC semiconductors related products

Code	Description
72821	<i>Machines & apparatus for the manufacture of boules & wafers, semiconductor devices/of electronic integrated circuits & flat panel displays</i>
72822	<i>Machines & apparatus solely/principally of a kind used for the manufacture/repair of masks & reticles, assembling semiconductor devices/electronic integrated circuits & lifting, handling, loading & unloading of boules, wafers, semiconductor</i>
72829	<i>Parts & accessories of heading 728.2</i>
77637	<i>Photosensitive semiconductor devices; light-emitting diodes</i>
77639	<i>Other semiconductor devices</i>
89846	<i>Semiconductor media for the recording of sound/of other phenomena</i>

Finally, the Semiconductor Industry Association – SIA is a trade association and lobbying group in Washington, D.C. that represents the United States semiconductor industry. It maintains the World Semiconductor Trade Statistics - WSTS database, which collects sales data from global semiconductor companies. WSTS covers over 200 product lines for all world regions, and has been used in several market studies.

The first two classifications will be used in the analyses below.

³ Also, a UN classification that can be mapped into the Harmonised System.

Outlining a strategy

In order to gauge Brazil's position in the world flows, the first attention goes to the country's exports and imports of the several items under concern, as described by the existing classifications. As Brazil is a rather modest exporter and a much more significant importer, this identification will probably lead to different sets of countries. Export destinations may be a preliminary suggestion of possible future markets; the import ones locate (geographically) its dependencies, which may also become partners in local developments.

The above position must be complemented by a view on both sides of the value chain centred on manufacturing, where investment or developments may make sense. It must also be contrasted with the relevance of the country for its main exporters, what may reinforce the likely opportunities for partnership.

A complete analysis would require moving to firm level data, what is not pursued here.

3. Results.

The 8542 products

The first set of Tables 1-3 analyses the 8542 group of products and shows Brazil's performance as importer and exporter. Yearly data are shown, from 2020 to 2022; figures are in US\$ millions and the six-digit 3-5 top exporters/importers of each good are listed, in value and as percentage of the total four-digit exports/imports. This last figure appears at the bottom of each sub-heading, together with the cumulated percentage of the countries displayed.

Table 1: Brazil – Exports and imports, chips; 2020.

Code	To/From	Value (US\$ m)	% Total
Exports			

854231	US	11,0	16%
	China	5,5	8%
	Vietnam	4,5	6%
854232	Vietnam	10,8	16%
	Rep. Korea	3,8	5%
854233	US	9,3	13%
854239	Vietnam	4,7	7%
8542	Total	69,7	(71%)
Imports			
854231	China	527,8	13%
	Other Asia	452,4	11%
	Vietnam	432,4	11%
	Rep. Korea	206,5	5%
	Malaysia	196,6	5%
854232	Rep. Korea	716,9	18%
854239	China	253,8	6%
	Other Asia	247,0	6%
8542	Total	4.061,7	(75%)

Source: UN Comtrade

Table 2: Brazil – Exports and imports, chips; 2021.

Code	To/From	Value (US\$ m)	% Total
Exports			
854231	US	7,4	11%
	Vietnam	5,9	8%
	China	4,2	6%
854232	Vietnam	17,6	25%
	Rep. Korea	3,8	5%

854233	US	4,6	7%
	Vietnam	2,4	3%
854239	Vietnam	2,0	3%
8542	Total	69,6	(68%)
Imports			
854231	China	703,0	14%
	Vietnam	565,7	11%
	Other Asia	549,7	11%
	Malaysia	287,8	6%
854232	Rep. Korea	912,4	18%
	China	243,2	5%
854239	China	299,5	6%
	Other Asia	280,7	5%
8542	Total	5.175,1	(76%)

Source: UN Comtrade

Imports, at the four-digit level, are in the order of billion US\$, with countries like China and the Republic of Korea being close to one billion in 2021 in certain subsectors (the latter also in 2020, for 854232). The US⁴ is not a top supplier, but is a significant importer of our 854231 and 854233 chips. Other Asia refers mostly to Taiwan and, very likely, to Taiwan Semiconductors Manufacturing Company - TSMC products. Our key suppliers are China, Other Asia (Taiwan) and the Republic of Korea –the latter probably thanks to Samsung. Vietnam seems to be gaining relevance.

This pattern is broadly kept in 2022, as Table 3 shows. The three main suppliers have kept their flows but, as regards exports, new relevant destinations appear, namely Hong Kong, Japan and India. It must be kept in mind that 2022 is the year when economies were slowly getting out of the pandemic, still suffering the semiconductors

⁴ Throughout the text, tables included, US and USA are used interchangeably for the United States of America. The same applies to Korea, Republic of Korea or Rep. Korea, all referring to the political-economic unit in the South (below parallel 38) of the Korean Peninsula.

shortage. Whether the newcomers are here to stay is something that only more recent data will inform.

Table 3: Brazil – Exports and imports, chips; 2022.

Code	To/From	Value (US\$ m)	% Total
Exports			
854231	US	16,1	19%
	Hong Kong	7,6	9%
	China	6,4	8%
	Japan	3,7	4%
854232	Vietnam	6,3	7%
	India	3,2	4%
854239	China	3,5	4%
	Vietnam	2,9	3%
8542	Total	85,4	(58%)
Imports			
854231	China	941,6	16%
	Other Asia	634,2	11%
	Vietnam	626,5	11%
	Rep. Korea	357,9	6%
854232	Rep. Korea	795,5	13%
	China	260,8	4%
854239	China	369,7	6%
	Other Asia	288,2	5%
8542	Total	5.897,2	(72%)

Fonte: UN Comtrade

Action, for Brazil, seems to concentrate in the first three subgroups for exports and in the first two for imports (basically, logic and memory chips, the country having no

significant imports of the “amplifiers” category (854233), in any of the three years), though 854239 keeps a presence in the latter. A simple measure of dependence would be to divide, for 8542 products, total imports by total exports. This gives, following the order of the years, *58,3; 74,4 and 69,1 times more imports*: an alarming signal of our needs in this area.

Considering only the top destinations shown in the tables, it is safe to say that at least around 60 percent of trade flows take place in these groups. The US is a key recipient for 854231 and 854233, and China, Korea and Other Asia are key suppliers. Vietnam appears in both sides of the flows.

The persistent relevance of the main partners, together with Malaysia, suggests computing Grubel-Lloyd (GL) indexes to investigate the possible existence of *intra-industry* trade between Brazil and each of China, Republic of Korea, Malaysia and Vietnam⁵ for the 8542 group, taking into account the five subsectors.

Given that the size discrepancies between imports and exports are very large, the index is unable to reveal an intra-industry pattern, presenting very low values. However, multiplying by 100 its values, a few insights appear.

Table 4 shows the results for the three years at stake (the index has a 0 – 100 range, increasing with the intensity of IA trade), both by country and the aggregate of the four. As expected, values are low but two things are noteworthy.

First, Vietnam is the one with a greater –though slight- suggestion of IA trade. Secondly, the trends are decreasing, signalling perhaps a worsening of Brazil’s domestic output, though less pronounced again with Vietnam, thanks to the 2021 increase. Combining the four countries, the weight of the three others together reproduces the declining trend.

The results in the first three tables can be deepened in a systematic way, in order to search for other potential partners. Appendix 1 presents for the same years, and the three first subsectors plus the aggregate of the two last ones, import and export data again.

⁵ Other Asia is a clear supplier only.

Table 4: GL Indexes

GL (x100)	2020	2021	2022
<i>Country results</i>			
China	1,73	0,82	1,43
Rep. Korea	1,12	0,71	0,23
Malaysia	1,37	0,31	0,99
Vietnam	4,44	5,03	3,71
<i>Aggregate results</i>			
	2,75	2,16	1,41

Now, for every subsector, the ten top partners are shown together with the percentage of their contribution *to subsector imports/exports*. The total respective value for the subsector, as well as the total number of partners are shown at the bottom.

Analysis of Tables A.1 and A.2 in the Appendix confirms the previous findings and adds a few new countries, mostly in Asia.

Brazil's imports, Table A.1, come mainly from China and, especially those of 854232, Korea. As in that group, something is also exported to Korea, the suggestion of intra-industry trade -duly framed by Table 4, however- reappears.

Table A.2 reveals that Vietnam, China and the US are key importers -probably of standard chips- together with a somewhat large group of countries that, with a neither regular nor very significant volume resort to the Brazilian goods. Argentina shows a modest presence, but for the last two groups in 2022.

A glimpse on two potential partners

In the two tables below, for HS codes 854231 and 854232, Vietnam's and Korea's major importers and exporters and their percent contribution, from 2020 to 2022, are shown. They are contrasted with the Brazilian position, which usually happens to be negligible (neg., i.e., shares lower than 0.01%), except as an importer of Vietnam's subgroup .32

(integrated circuits; memories). Perhaps as expected, they clearly show that Brazil is outside the actual, relevant flows of semiconductors' trade.

Vietnam (Table 5) which is not necessarily a main node in this trade network, is mostly supplied by the US, Korea and Ireland -for .31- and China and Other Asia -for .32. It sells basically to, again, the US and Korea, as well to China, Singapore and India. Notwithstanding, Brazil is a relatively significant destination for memory chips (.32).

For the Republic of Korea (Table 6), a more advanced and sophisticated producer than Vietnam, Brazil is a negligible supplier, its sourcing being concentrated in the Asian nexus and the US, with Other Asia/Taiwan and China holding top positions in .31 and .32, respectively. Brazil is however a minor exports destination, with shares usually around 1%.

This analysis can be pursued to other partners, but for the purposes of this Brief it suffices to show the close to irrelevant international position of Brazil in this market.

Table 5: Vietnam – Main import and export flows of .31 and.32 chips, 2020 to 2022.

Code	IMPORTS			EXPORTS		
	2020	2021	2022	2020	2021	2022
854231	USA (30.7%) Ireland (26.6%) Other Asia (17.6%) ...	USA (24.9%) Ireland (23.4%) Rep. Korea (15.9%) ...	Rep. Korea (26.4%) USA (15.9%) Ireland (15.5%) ...	China (57%) Hong Kong (21.3%) Other Asia (9.4%) ...	China (53.3%) Hong Kong (27.4%) USA (3.8%) ...	China (56.2%) Hong Kong (18.7%) USA (5%) ...
	Brazil (neg.)	Brazil (0.03%)	Brazil (neg.)	Brazil (0.2%)	Brazil (1%)	Brazil (0.9%)
Total (US\$ m)	14 383	17 884	16 693	13 019	13 152	11 701
854232	Rep. Korea (65.5%) Other Asia (16.4%) China (8.7%) ...	Rep. Korea (76.3%) Other Asia (11.9%) China (8.7%) ...	Rep. Korea (69.6%) Other Asia (16.1%) China (11.4%) ...	Rep. Korea (34.7%) India (28%) Singapore (20.5%) ...	Rep. Korea (30%) India (26.9%) Turkey (16%) Indonesia (4.6%)	Turkey (30.8%) Rep. Korea (17.4%) India (14.4%) Singapore (12.4%) Brazil (11.6%)
	Brazil (0.02%)	Brazil (0.3%)	Brazil (0.1%)	Brazil (6.3%) USA (3.3%)	Brazil (14.6%)	
Total (US\$ m)	2 079	5 154	4 462	69	191	185

Table 6: Korea – Main import and export flows of .31 and.32 chips, 2020 to 2021.

Code	IMPORTS			EXPORTS		
	2020	2021	2022	2020	2021	2022
854231	Other Asia (44.7%)	Other Asia (46.8%)	Other Asia (50.2%)	China (38.1%)	China (44%)	China (45.8%)
	USA (12.1%)	Japan (12.4%)	Japan (16.9%)	Other Asia (15.9%)	Other Asia (14.1%)	Singapore (16.1%)
	Japan (12%)	China (11.4%)	China (8.9%)	Singapore (11.8%)	Singapore (12.6%)	Other Asia (12.1%)

	Brazil (neg.)	Brazil (neg.)	Brazil (neg.)	Brazil (1.8%)	Brazil (1.1%)	Brazil (1.2%)
Total (US\$ m)	18 476	22 533	29 386	17 797	25 475	32 450
854232	China (87.3%)	China (87.8%)	China (88.4%)	China (57.4%)	China (53%)	China (57.9%)
	Other Asia (4.4%)	Other Asia (4.7%)	Other Asia (3.6%)	Hong Kong (27.7%)	Hong Kong (29.1%)	Hong Kong (22.7%)
	Hong Kong (1.8%)	Hong Kong (2.1%)	Hong Kong (3.1%)	Other Asia (5.1%)	Other Asia (6.9%)	Other Asia (7.4%)

	Brazil (0.02%)	Brazil (0.01%)	Brazil (neg.)	Brazil (0.9%)	Brazil (0.9%)	Brazil (0.9%)
Total (US\$ m)	15 327	18 776	20 065	35 722	63 085	54 825

A first look on the value chain, mainly the final goods side

Table 7 displays imports and exports for the six SITC groups presented in the previous section. For the manufacturing inputs (7282 subgroups) exports are either negligible or very small. They remain roughly the same for the final goods, with the exception of the *media for the recording of sound/of other phenomena* (89846), where values around 6 to 8 tens of millions are found.

As regards imports, values for the inputs are low as the country is neither a sophisticated nor a great producer of chips. For the final goods however, imports may reach a few billions, being in general far superior than the exports.

Table 8 displays main origins and destinations of imports and exports, respectively, for selected intermediate and final consumer goods using semiconductors, with at least one of the totals, for a given good, being superior to 50 m US\$. Interest lies basically in that, when moving to the higher end of the value chain, partners become more diversified. Exports contemplate South American and European countries, while imports, despite still concentrated in the Asia-US nexus, include a few European origins.

Table 7: Brazil – Imports and Exports of Selected Inputs and Final Goods related to Chips, 2020 to 2022.

Code	IMPORTS*			EXPORTS*		
	2020	2021	2022	2020	2021	2022
72821	4,92	3,32	2,05	0,01	0,06	0,01
72822	5,45	12,95	14,95	0,33	1,33	0,28
72829	3,39	2,90	3,52	0,20	5,61	0,22
77637	1 170,13	2 724,92	4 052,90	2,42	3,11	1,16
77639	1 147,75	1 158,22	1 792,85	0,86	4,13	0,20
89846	258,73	319,89	203,92	586,9	673,5	766,1

Note: for the meaning of the codes see Exhibit 2.

* IMPORTS in millions and EXPORTS in 100.000 US\$.

Table 8: Brazil - Exports and imports of intermediate and final goods: electronics incorporating semiconductors, 2020						
Code	Exports			Imports		
	To	Value (US\$ m)	% Total	From	Value (US\$ m)	% Total
851712	United States	15,4	95%	China	624,8	96%
	United Kingdom	0,3	2%	Hong Kong	5,9	1%
	Korea	0,2	1%	Malaysia	4,8	1%
	World	16,2		World	651,5	
851761	Sweden	16,5	29%	United States	53,9	63%
	Mexico	16,3	28%	Estonia	14,3	17%
	Argentina	4,4	8%	Spain	3,5	4%
	World	57,2		World	85,1	
851762	Mexico	38,4	39%	China	723,8	58%
	United States	20,2	21%	United States	106,1	8%
	Netherlands	4,5	5%	Mexico	96,1	8%
	World	98,3		World	1249,6	

851770	China	25,5	31%	China	1574,1	59%
	Hong Kong	13,9	17%	Vietnam	804,5	30%
	Vietnam	10,0	12%	Hong Kong	120,0	4%
	World	81,0		World	2668,3	
852580	United States	9,0	40%	China	53,8	51%
	Philippines	7,7	34%	United States	12,0	11%
	Mexico	3,1	14%	Mexico	6,3	6%
	World	22,5		World	105,0	
950450	United States	0,9	81%	China	77,0	86%
	United Arab Emirates	0,2	18%	Vietnam	9,0	10%
	Argentina	0,0	1%	Other Asia	2,3	3%
	World	1,1		World	89,4	

Key to the codes: The following are intermediate consumer goods, 851761 – base stations; 851762 – communication apparatus (excluding telephone sets or base stations), machines for the transmission or reception of voice, images or other data, including switching and routing apparatus; the remaining ones are final consumer goods, defined in Exhibit 1.

This view is complemented by Table 9, which contains the same information, now for 2022, and a few more goods, as the 50 m US\$ restriction has been lifted. While imports continue dominated by the Asia-US area -with Mexico maybe as a disguised US plus-, the portfolio of destinations has been broadened, with more South American countries and the appearance of Turkmenistan in the television and digital cameras and video recorders 852580 subgroup.

It is also worth mentioning the complete dependence on China as regards video games (950450) imports.

Table 9: Brazil - Exports and imports of intermediate and final goods: electronics incorporating semiconductors, 2022

Code	Exports			Imports		
	To	Value (US\$ m)	% Total	From	Value (US\$ m)	% Total
851712	United States	10,1	57%	China	1176,0	82%
	China	4,8	27%	Indonesia	75,9	5%
	Paraguay	0,8	5%	Japan	40,7	3%
	World	17,7		World	1428,9	
851718	Ecuador	0,5	39%	China	10,9	88%
	Colombia	0,2	14%	Vietnam	0,3	3%
	Uruguay	0,1	10%	United States	0,3	2%
	World	1,2		World	12,4	
851761	Mexico	55,9	43%	China	22,2	36%
	Chile	16,6	13%	United States	14,9	24%
	United States	13,1	10%	Mexico	7,6	13%
	World	128,8		World	61,0	
851762	United States	40,8	36%	China	685,1	50%
	Mexico	15,7	14%	United States	147,4	11%
	Netherlands	8,9	8%	Other Asia	97,9	7%
	World	114,2		World	1358,2	
851769	Germany	0,2	49%	United States	7,7	37%
	United States	0,1	16%	China	6,2	30%
	Hungary	0,0	6%	Mexico	2,6	13%
	World	0,5		World	20,6	
851770	Hong Kong	11,1	27%	China	1212,7	63%
	Vietnam	9,8	24%	Vietnam	598,4	31%
	United States	3,4	8%	Hong Kong	35,4	2%
	World	40,6		World	1927,9	
851890	United States	1,0	72%	China	35,7	85%
	Argentina	0,2	18%	Vietnam	1,7	4%
	Paraguay	0,0	3%	Hong Kong	1,1	3%
	World	1,3		World	41,8	

852580	Turkmenistan	4,1	43%	China	69,2	50%
	United States	2,9	31%	United States	17,3	12%
	China	1,1	12%	Japan	6,5	5%
	World	9,6		World	139,7	
950450	United States	0,5	62%	China	204,9	99%
	Chile	0,1	15%	Japan	0,3	0%
	Paraguay	0,1	14%	United States	0,2	0%
	World	0,9		World	206,0	

Key to the codes: The following are intermediate consumer goods, 851761 – base stations; 851762 – communication apparatus (excluding telephone sets or base stations), machines for the transmission or reception of voice, images or other data, including switching and routing apparatus; 851769 – communication apparatus (excl. telephone sets or base stations), machines for the transmission or reception of voice, images or other data (incl. wired/wireless networks), n.e.c. in item 8571.6; 851890 – microphones, headphones, earphones, amplifier equipment, parts of the equipment of group 8518; all the remaining ones are final consumer goods, defined in Exhibit 1.

4. Conclusion.

International trade data shows the serious dependence of Brazil on the Asia-US nexus of the semiconductors value-chain. The country seems able to counter this situation not in terms of becoming autonomous -something ridiculously impossible- but in diminishing the present global, huge trade imbalance and achieving a relative autonomy in specific chips and selected intermediate & final consumer goods.

Indeed, as regards the end of the value chain, a market can be enlarged both in South America and Europe, not forgetting possible penetrations in the Middle East and Central Asia.

Concentrating on the inputs side does not look promising, but in the manufacturing process itself, Brazil can certainly increase both its output and exports -of standard or not so advanced chips- to technologically intermediate Asian destinations, like Malaysia and Vietnam. China and the Republic of Korea stand out as potential key partners for joint ventures, deeper trade prospection and, with due attention, careful planning and a zest of luck, technology transfer.

Though presenting a not very positive picture, the results add weight to the position that using trade to enhance the country's status in the world semiconductors market is both feasible and unavoidable.

Will and hard work must enter stage.

APPENDIX

The two tables below show a more detailed view of importers and exporters, as regards sector 8542 in Brazil. As mentioned in the text, for the same years and the three first subsectors plus the aggregate of the two last ones, import and export data for the ten top partners are shown, together with the percentage of their contribution *to subsector imports/exports*. The total respective value for the subsector, as well as the total number of partners are shown at the bottom.

Table A.1 displays suppliers. The relevance of China, Republic of Korea, Other Asia, Vietnam and Malaysia is confirmed, while a few new countries appear. They can range from fairly insignificant presences as Thailand and Philippines, to a certain insertion from Japan and, more relevant, of Hong Kong and Mexico, the latter concentrated in subgroup .33. Singapore has a modest though widespread and persistent presence. It is hard to tell at this level, whether it does not stand as a final port for chips manufactured in Malaysia or even China. The same applies for .33 (integrated circuits; amplifiers) coming from Mexico, that accordingly could originate either in the US or a *maquila*.

Table A.2 broadens the knowledge on importers. Globally, Vietnam stands as the key importer, followed by the US -which dominates in subsectors .31 and .32, despite an odd fall in 2022- and then China. Enlargement to the ten top partners displays new destinations like India, Turkey (only in 2022), Argentina and a few European economies, that could deserve attention in a more detailed analysis.

Table A.1: Brazil - Main Chips' (product 8542) Suppliers, 2020 to 2022.

Code	2020	2021	2022	Code	2020	2021	2022
854231	China (26.0%)	China (27.2%)	China (29.7%)	854233	China (37.7%)	China (39.9%)	China (32.4%)
	Other Asia (22.3%)	Vietnam (21.9%)	Other Asia (20.0%)		Other Asia (12.0%)	Rep. Korea (13.3%)	Rep. Korea (25.4%)
	Vietnam (21.3%)	Other Asia (21.2%)	Vietnam (19.8%)		Rep. Korea (9.8%)	Other Asia (13.0%)	Other Asia (13.4%)
	Rep. Korea (10.2%)	Malaysia (11.1%)	Rep. Korea (11.3%)		Japan (8.9%)	Mexico (6.6%)	Vietnam (6.1%)
	Malaysia (9.7%)	Rep. Korea (7.6%)	Malaysia (7.8%)		Hong Kong (6.3%)	Vietnam (5.9%)	Mexico (4.0%)
	Singapore (3.2%)	Singapore (3.0%)	Singapore (2.6%)		Mexico (6.0%)	Hong Kong (4.5%)	Japan (3.9%)
	USA (1.7%)	Japan (1.7%)	Japan (2.3%)		Vietnam (4.6%)	Malaysia (4.0%)	Hong Kong (3.8%)
	Thailand (1.0%)	USA (1.6%)	USA (1.6%)		USA (4.5%)	USA (4.5%)	Malaysia (3.3%)
	Japan (0.9%)	Thailand (1.0%)	Hong Kong (0.9%)		Malaysia (3.8%)	Singapore (3.9%)	Singapore (2.5%)
	Hong Kong (0.8%)	France (0.9%)	Thailand (0.9%)		Singapore (3.2%)	Japan (3.6%)	Philippines (1.1%)
	Total partners	56	59		63	Total partners	34
Total (US\$ m)	2 032	2 588	3 170	Total (US\$ m)	121	132	170
854232	Rep. Korea (69.0%)	Rep. Korea (63.2%)	Rep. Korea (68.4%)	854239 + 854290	China (29.5%)	China (29.6%)	China (31.0%)
	Other Asia (13.0%)	China (16.9%)	China (19.1%)		Other Asia (28.7%)	Other Asia (27.7%)	Other Asia (24.1%)
	China (11.5%)	Other Asia (11.3%)	Other Asia (10.9%)		Rep. Korea (10.5%)	Rep. Korea (9.6%)	Rep. Korea (11.6%)
	Singapore (3.9%)	Singapore (3.8%)	Singapore (4.8%)		Singapore (5.1%)	Malaysia (4.8%)	Vietnam (4.9%)
	USA (0.9%)	Japan (1.6%)	Japan (2.1%)		Malaysia (4.4%)	Japan (3.9%)	Malaysia (4.6%)
	Japan (0.7%)	Hong Kong (0.8%)	Vietnam (1.6%)		Vietnam (4.0%)	Singapore (3.8%)	Singapore (4.0%)
	Philippines (0.3%)	USA (0.7%)	Hong Kong (0.8%)		Japan (3.7%)	Vietnam (3.6%)	Philippines (3.3%)
	Thailand (0.3%)	Thailand (0.4%)	Thailand (0.6%)		Philippines (3.2%)	Philippines (3.4%)	Thailand (3.3%)
	Malaysia (<0.1%)	Vietnam (0.4%)	Malaysia (0.5%)		Thailand (2.2%)	Thailand (2.8%)	Japan (2.9%)
	Samoa (<0.1%)	Malaysia (0.4%)	USA (0.5%)		Hong Kong (2.2%)	Hong Kong (2.2%)	Mexico (2.5%)
	Total partners	47	45		46	Total partners	67
Total (US\$ m)	1 039	1 441	1 361	Total (US\$ m)	862	1 013	1 194

Table A.2: Brazil - Main Chips' (product 8542) Importers, 2020 to 2022.

Code	2020	2021	2022	Code	2020	2021	2022		
854231	USA (27.8%)	USA (39.6%)	USA (30.8%)	854233	USA (57.8%)	USA (72.5%)	Vietnam (60.7%)		
	Vietnam (22.3%)	China (19.9%)	Vietnam (14.5%)		Vietnam (29.7%)	Vietnam (13.6%)	India (15.6%)		
	China (15.7%)	Vietnam (16.2%)	China (12.3%)		Rep. Korea (3.5%)	China (2.4%)	Rep. Korea (5.5%)		
	UK (4.9%)	Rep. Korea (4.7%)	Japan (7.1%)		Indonesia (1.1%)	Rep. Korea (2.3%)	USA (5.4%)		
	Mexico (4.3%)	Poland (3.4%)	Netherlands (5.0%)		Argentina (0.7%)	Qatar (1.1%)	China (3.9%)		
	Hong Kong (4.3%)	Hong Kong (3.1%)	Argentina (4.0%)		Hong Kong (0.7%)	Sweden (1.1%)	Indonesia (2.9%)		
	Other Asia (3.3%)	Mexico (3.0%)	Hungary (3.6%)		Panama (0.6%)	Argentina (1.0%)	Singapore (2.5%)		
	Poland (3.1%)	Other Asia (2.5%)	Germany (3.6%)		Sweden (0.6%)	Panama (0.8%)	Argentina (2.3%)		
	France (2.6%)	Malaysia (1.2%)	Vietnam (3.3%)		France (0.4%)	Turkey (0.7%)	Hong Kong (2.4%)		
	India (1.4%)	Colombia (1.1%)	India (2.5%)		Canada (0.4%)	Italy (0.5%)	Turkey (2.2%)		
	Total partners	62	56		62	Total partners	46	53	37
	Total (US\$ m)	26	28		52	Total (US\$ m)	8	13	4
	854232	Vietnam (66.5%)	Vietnam (54.3%)		Vietnam (46.7%)	854239 + 854290	Vietnam (23.4%)	Vietnam (47.2%)	China (29.3%)
Rep. Korea (14.2%)		Rep. Korea (19%)	India (24.2%)	China (10.6%)	China (10.0%)		Vietnam (18.9%)		
Other Asia (5.2%)		China (7.2%)	China (10.5%)	USA (10.5%)	USA (8.3%)		USA (10.0%)		
Hong Kong (4.7%)		Malaysia (5.8%)	Hong Kong (7.5%)	Hong Kong (8.3%)	Poland (6.4%)		Hong Kong (7.2%)		
India (3.2%)		Hong Kong (3.8%)	Rep. Korea (2.5%)	India (5.7%)	Rep. Korea (4.1%)		Malaysia (6.2%)		
USA (1.5%)		USA (2.1%)	USA (2.1%)	Mexico (4.7%)	Hungary (3.1%)		India (5.3%)		
China (1.0%)		Other Asia (1.1%)	Argentina (1.7%)	Saudi Arabia (3.4%)	India (2.7%)		Thailand (3.9%)		
Germany (0.9%)		Singapore (0.9%)	Thailand (1.1%)	UK (2.7%)	Netherlands (1.8%)		México (2.4%)		
Mexico (0.8%)		Poland (0.3%)	Other Asia (0.8%)	Rep. Korea (2.6%)	Mexico (1.7%)		United Kingdom (2.1%)		
Poland (0.6%)		Thailand (0.1%)	Indonesia (0.8%)	Germany (2.2%)	Malaysia (1.7%)		França (2.1%)		
Total partners		46	39	42	Total partners		64	57	65
Total (US\$ m)		26	27.8	13	Total (US\$ m)		9	9	15