PSL Quarterly Review

vol. 77 n. 310 (September 2024)

Special issue on structural change, social inclusion, and environmental sustainability

Structural change, commodity dependence and middle-income trap: Emerging approaches to a traditional agenda

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Abstract:
The objective of this paper is to revisit key themes of development literature in the light of novel emerging approaches. Applying complexity economic tools, evidence is presented to argue that, along the development trajectory of countries, a complexity increase, to be sustainable, must go hand in hand with a departure from their productive historical path, in the form of unrelated diversification. Also, it is argued that successful trajectories must avoid the middle-income trap (MIT), which is shown to stem from the interplay of supply and demand factors. Finally, building on balance of payments constrained growth literature, a theoretical model is proposed to explain the high prevalence of MIT situations among commodity-dependent countries. It is suggested that this phenomenon arises from the interaction of commodity price volatility and real exchange rates, which affects the accumulation of sophisticated productive capabilities.

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How to cite this article:
Isabella F. (2024), "Structural change, commodity dependence and middle-income trap: Emerging approaches to a traditional agenda", *PSL Quarterly Review*, 77 (310), pp. 329-350.

DOI: https://doi.org/10.13133/2037-3643/18653

JEL codes:
B52, F42, O11

Keywords:
economic development, middle-income trap, structural change, commodity dependence

Journal homepage:
http: //www.pslquarterlyreview.info

Structural change is perhaps one of the most important and traditional issues in heterodox economics, since classic development theorists, at the middle of the last century, placed it at the center of their analysis (see, for example, Prebisch, 1949; Lewis, 1954; Hirschman, 1977). In most traditional analyses, it was interpreted simply as industrialization, reflexing a quite naïf trust in the economic and social changes that process would unleash. Many developing countries, mostly during the second half of the twentieth century, embarked on vast projects and policies with the aim of promoting manufactures, many times indiscriminately and lacking any detailed medium-run planning. In many countries in the developing world, manufacturing was indeed the locomotive that dragged growth. But in most cases, notably Latin America, the results were finally disappointing. As Alfred Hirschman (1968, p. 32) notably stated: "Industrialization was expected to change the social order but all it did was to supply manufactures".

Development proved to be a much more elusive target, encompassing much beyond the composition of production, including social capabilities, external and internal equilibriums, and social and political alliances to support ambitious policies. Also, in the last decades, it has become clear that the challenges faced during the development process are not only changing but probably increasingly complex, and that the strategies and policies that proved effective in escaping from low-income situations will not necessarily be useful in addressing the challenges faced as the development process advances (Bianchi et al., 2023). The objective of this paper is to reexamine key themes in development economics by exploring their interconnectedness through novel emerging approaches.[1]

1. Structural change

As previously stated, structural change has been at the center of theoretical and, more recently, empirical analysis within heterodox literature for a long time. A review of that historical tradition is far beyond the scope of this paper, but the basic idea implicit in the rest of the article is that it is related to a redefinition of the role of the country (region) in the international division of labor, based on a significant change in the production sectors and activities in which it is specialized. That division of labor is part of a global and unequal system, which determines much more than just a division of tasks. As a consequence of the position in the system that countries hold, their development possibilities are deeply affected, including their participation in the generation of, diffusion of, and access to technological change. Also the market structures in which countries participate depend on that position, what determines the formation of prices and the possibilities to retain or transfer productivity gains and surpluses, and, so, their conditions to invest in capabilities formation (Rodriguez, 2006; ECLAC, 2007, 2012).

The main objective of structural change is to obtain a more virtuous specialization, which should encompass at least two dimensions. On the one side is what is known as a *Keynesian efficiency*, associated with accessing a more dynamic demand. Different products and services satisfy different necessities, which determines variable patterns of demand growth, in relation to income level and growth and technological change. The positioning in strands of production related to increasing demand allows an economy to not only sustain prices and impulse production but also exploit dynamic economies of scale and learning, in a Kaldorian inspiration (Blecker and Setterfield, 2019). On the other hand, is the *Schumpeterian efficiency*, which is related to the supply side, specifically to the technological dynamic of the sectors and activities in which the country (region) is specialized. The idea is that certain sectors and activities are more directly related to the more disruptive technological innovations in each historical period, like software to digital revolution at the beginning of the twenty-first century, or transport to steam power control in the mid-nineteenth century, which determines rising and declining trends of different industries to key positions in productive structure. That changing relationship determines an advantage for those who are specialized in those rising sectors to develop and firstly adopt and adapt new technologies to their particular necessities; this increases productivity and paves the way to the development of new applications for rising technologies, diversifying economies and capturing technological rents (Freeman and Perez, 1988; Freeman and Louça, 2001; Dosi et al., 2022).

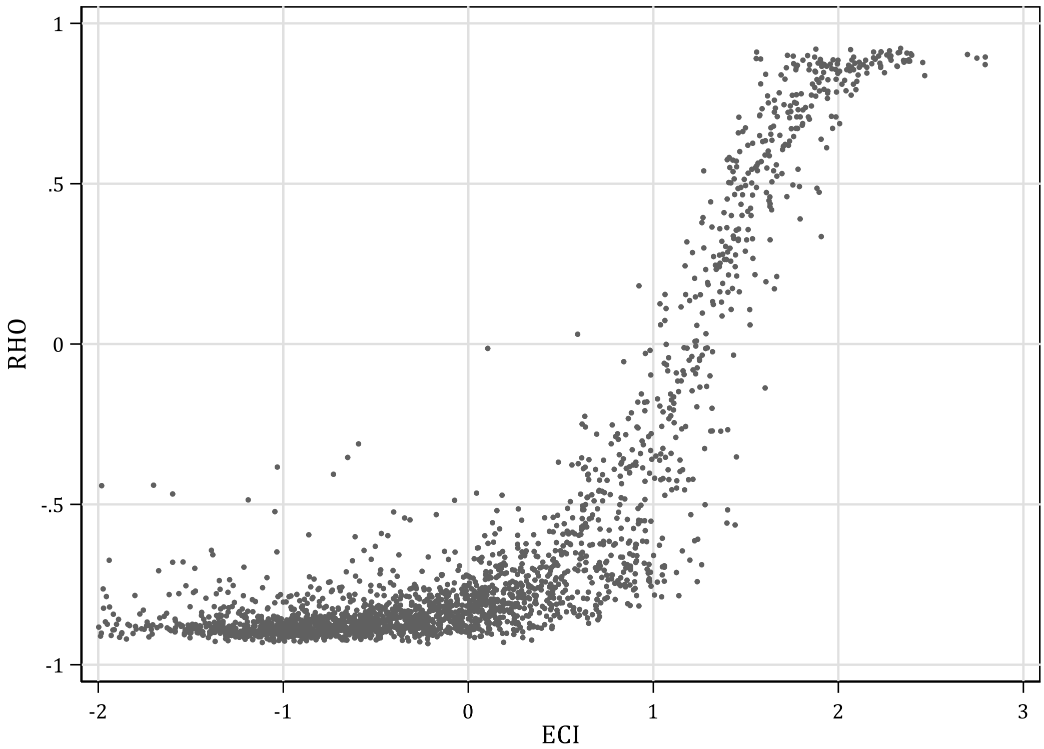
[1] These ideas stem from the research lines carried out by the Development Group at the Institute of Economics (IECON) in the Universidad de la República, Uruguay.

Recently there has developed a vibrant strand of literature regarding these issues, by the application of economic complexity tools (Hausmann et al., 2014; Hidalgo, 2021). Economic complexity theory and techniques, based on data on the geography of activities, extract information of the diversity and sophistication of the factors or inputs present in an economy and, in that way, about an economy's capacity to generate and distribute income. They are based on the processing of large amounts of data (trade data, for example) from which it is possible to infer information about the diversity of knowledge and capabilities present in a location. Their main contribution to development literature is that they allow for the quantification and measurement of what were previously mainly exclusive theoretical concepts, thus boosting empirical research. One of the main indicators arising from this literature is the Economic Complexity Index (ECI), which assesses, in an articulated and recursive way, the diversification and the exclusiveness of production in a certain location, as indicators of economic complexity. The ECI is then normalized to get an indicator centered in zero and what distributes to the negative and the positive sides. A mirror indicator to the ECI but one that applies to products is the Product Complexity Index (PCI). Moreover, *relatedness* indicators measure the affinity between a specific product or activity and a location, based on the capabilities already present at the location (inferred from the current production) and those necessary to competitively produce the product or to develop the activity.

This literature builds on Product Space (PS) literature (Hausmann and Klinger, 2007; Hidalgo et al., 2007). The most important indicator proposed for this framework is the proximity, which relates to the relationship between two products and is calculated as the likelihood that both products are present together in the export basket of a certain country. It is interpreted as the degree of similarity of the capabilities required to produce them competitively and, so, the likelihood that a country that produces one of them may start producing the other one. Using the proximity between all possible pairs of products, it is possible to create a spatial representation of the PS, where each product is located in relation to the other according to their pairwise proximity or distance (the inverse of proximity). From that exercise, it can be corroborated that the PS is composed of a dense core, where the most sophisticated products tend to cluster, and a sparse periphery, where less sophisticated products show much lower proximity to any other product and especially to more sophisticated ones. On this basis, the specialization of countries or regions in products mainly located in the core or in the periphery determines their possibilities to diversify and increase the complexity of their productive structure, in what can be understood as an empirical representation of the Centre-Periphery system depicted by Structuralism.

Building on these ideas, recently Hartmann et al. (2021) and Pinheiro et al. (2022), proposed a new visual representation of productive structure and structural change. It is a two-dimensional plane that locates countries according to their productive structure. On the horizontal axis, it measures the ECI and on the vertical axis it measures another indicator that the authors call Rho. This is basically a relatedness indicator, which shows the correlation between, on the one hand, density (a measure of proximity but that relates one specific product to a whole productive structure, that is, to a set of products currently produced by a location) from the current productive structure of the country to any non-produced good and, on the other, the sophistication (measured through the PCI) of those non-produced goods. So, a high (positive) value of this indicator (as a correlation it spans from –1 to 1) means that the closer (higher density to) the non-produced products, the more sophisticated they are; this means that the country is located in the dense core of the PS and that its possibilities to diversify and increase sophistication are high. Inversely, the lower the indicator, the closer the non-produced products, the less sophisticated they are, signaling that the country is located in the periphery of the PS. So, while the horizontal axis measures the sophistication of the current productive structure, the vertical axis measures the potential to transform the structure towards more sophistication. Each spot on the graph corresponds to a specific country (or region) in a specific period, so it is possible to track historical trajectories of countries along history.

Figure 1 – *Countries/period located in the ECI – Rho plane*

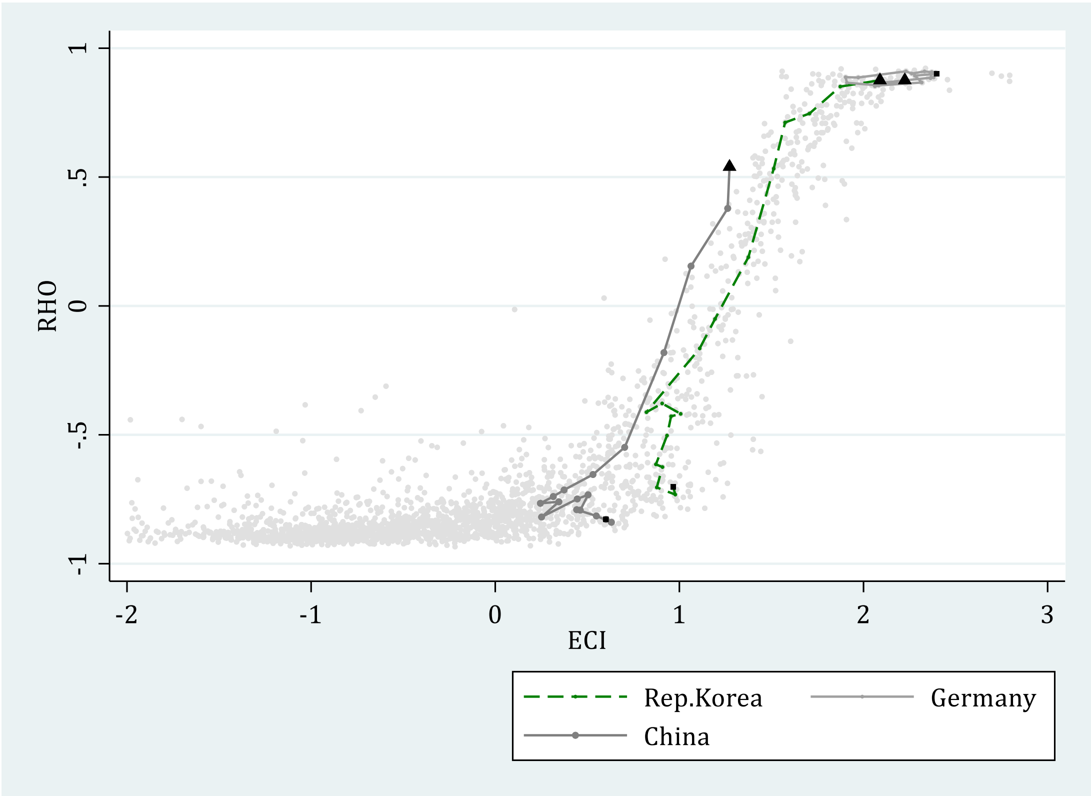


Source: Own elaboration based on The Atlas of Economic Complexity (Hausmann and Hidalgo, 2011).

In this way, a horizontal move in the graph (to the right) may be interpreted as "related diversification" (Saviotti and Frenken, 2008; Pinheiro et al., 2022) because it means that the country is increasing its complexity but without changing its position within the PS; in other words, it is moving to products that are located in the same region of the PS as the average product previously produced. This may be a possible way to increase complexity, especially for countries departing from very low complexity levels but, as can be seen in figure 1, it has a limit: once countries get to intermediate complexity levels, they can only sustain the complexity increase by engaging in vertical moves, which means unrelated diversification, thus structural change. The increase in the relatedness level is only possible by adding to the productive structure new products or activities that are closer to the dense core of PS than the average previously produced product. This situation can be thought as the country moving across the PS towards its core.

The historical trajectories of countries in the plane just explained depict an "*S*" shape, as can be seen in figure 1, which is built with data from 1962 to 2017 grouped in triennials. Moving along the *S* line, horizontally and vertically at the same time, means economic development. At intermediate levels of complexity, there is a "high step", which is an almost vertical section of the figure, defined by the already mentioned need to increase relatedness to continue increasing complexity. Climbing that "high step of development" (Bianchi et al., 2024a), as will be shown next, is one of the main challenges to development. Figure 2 and figure 3 show some historical trajectories of countries.

Figure 2 – *Historical trajectories of Germany, South Korea and China in ECI – Rho plane (1962-2017)*

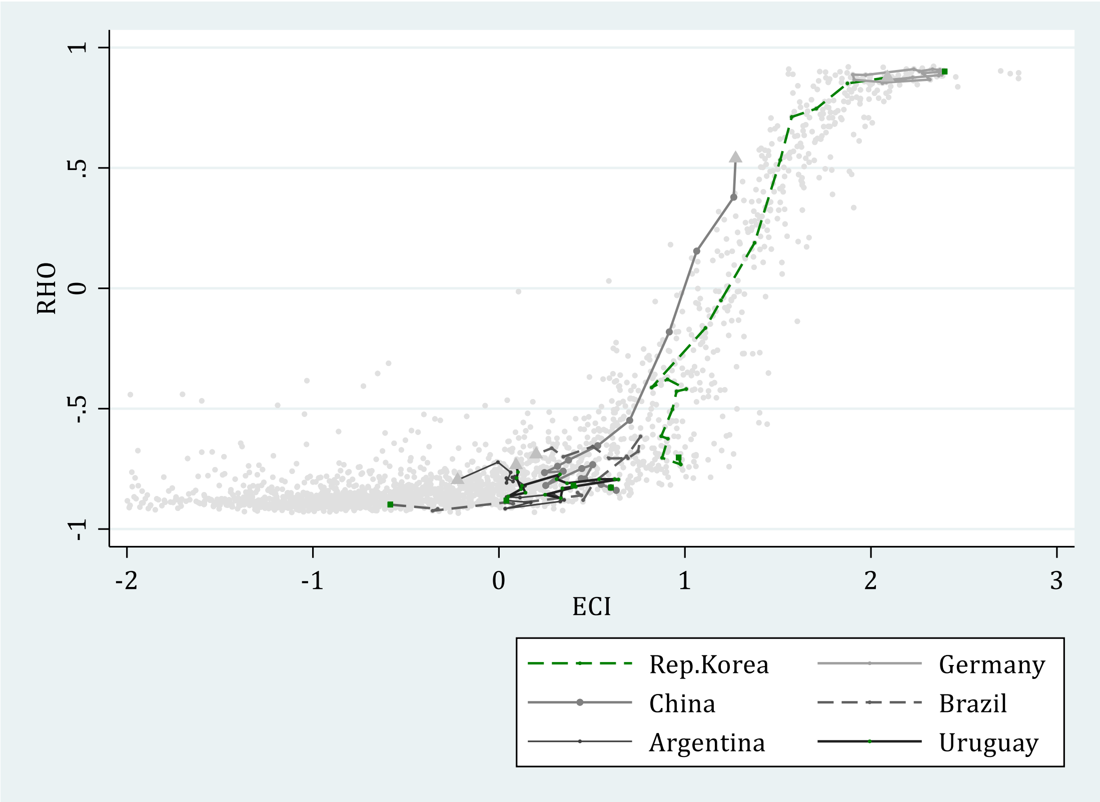


Note: The triangle signals the last data (period 2015-2017).
Source: Own elaboration based on The Atlas of Economic Complexity (Hausmann and Hidalgo, 2011).

Figure 2 shows the historical trajectory of three countries. The grey line at the top of the figure shows the trajectory of Germany (West Germany before 1990), which has been, all along the period, considered a highly developed country, so it shows a very high complexity level as well as a very high level of relatedness. It is a very sophisticated economy and so it is located in the dense core of the PS, what means that it not only produces highly sophisticated products but that the closest products not produced are highly sophisticated as well. Perhaps more interesting is the trajectory followed by two catching-up experiences. The green line tracks the South Korean trajectory, a twentieth-century catching-up country. Departing from intermediate complexity and low relatedness levels, it went through a deep structural change to reach very high levels in both dimensions. The grey line departing from low levels in Rho dimension shows the trajectory of China, a twenty-first century and ongoing catching-up experience; it shows a significant time lag in relation to Korea but then what seems to be a parallel trajectory. Both are cases of active developmental-states, in which a strategic planning-oriented state, hand in hand with the private sector (more so in the Korean case than in the Chinese case, but actually in both), led the economy to overcome productive development traps, building productive and technological capabilities (Mazzucato, 2011; Lee, 2013).

But not all are successful stories. Figure 3 includes the trajectories of three middle-income South American experiences.

Figure 3 – *Historical trajectories of Germany, Korea, China, Brazil, Argentina and Uruguay in ECI – Rho plane (1962-2017)*



Note: The triangle signals the last data (period 2015-2017).
Source: Own elaboration based on The Atlas of Economic Complexity (Hausmann and Hidalgo, 2011).

In figure 3 the trajectory of Brazil, departing from low levels of complexity in the 1960s, shows an interesting process of economic development with structural change until the last 1990s, when it reverted and started to lose complexity. This trajectory coincides with the Structuralist and New Developmentalist narrative of Latin American (in general) and with Brazilian (in particular) development processes. In those views, the industrialization led by the state since the 1930s until the 1980s, despite important policy mistakes and cumulative disequilibriums, reached very important achievements, because it boosted an important process of capabilities accumulation that increased the complexity of the economies. But after the debt crisis at the beginning of the 1980s, and especially hand in hand with the Washington-Consensus-oriented policies during the 1990s, the trend to privatization to opening and deregulating the economies, dismantled the strengths previously achieved (Bértola and Ocampo, 2012; Bresser-Pereira et al., 2015; Cimoli et al., 2019). The trajectories of Argentina and Uruguay, despite less notable previous achievements, follow similar patterns of random detours, without a clear trend towards structural change and without being able to climb the "high step of development".

From this brief review of historical experiences, some insights of development processes can be drawn. In the first place, a sustainable path to development, departing from low or intermediate complexity levels, requires not only complexity increases but also a break with previous production tradition in the form of unrelated diversification, which, in turn, paves the way to sustained complexification. In this way, it can be stated that unrelated diversification seems to be essential, particularly at intermediate levels of complexity. In the same vein, despite a positive relationship, it is clear that there is not a linear relation between complexity and structural change. At low levels of complexity, it is possible to increase it without significant departure from previous production patterns, which means an almost flat relationship. However, once intermediate levels are reached, the curve gets steeper, creating a "high step of development", so that additional complexification is not possible without a deep structural change that modifies the location of the country within the PS. That steep section of the curve constitutes a crucial challenge to development and can be understood as a development trap.

2. Structural change and the middle-income trap

As the reader may have guessed, the development trap that arises at middle complexity levels is also known in the literature by a different name. This is where the Middle-Income Trap (MIT) comes into the picture.

From a statistical point of view, the MIT has been defined, and its existence tested, as recurrent growth slowdowns that arise when countries reach middle-income levels (Eichengreen et al., 2012, 2013). But, from a conceptual perspective, it has been explained as a consequence of a double constraint on competitiveness that countries which have experienced important growth processes eventually face. On the one hand, they are no longer able to compete in standardized production sectors or activities based on low costs, on which their previous growth processes were based, because they experienced important cost increases as a result of those processes. Sustained growth is associated with social and political pressures to increase the standards of living of important sectors of population; this includes increased salaries, better social services that require higher taxes, and stricter labor and environmental regulations, all of which translate to increased production costs. Those pressures are a natural part of development and, what is more, they are positive forces toward democratization of the fruits of growth and, indeed, are necessary for the construction of capabilities indispensable to sustain the process (Paus, 2014; Porcile and Sanchez-Anconchea, 2021).

But, on the other hand, and related to this, countries in the MIT are not able to suddenly compete in sophisticated sectors and activities, which could sustain the improvements in the standard of living of the population; they still lack the needed capabilities, whose construction requires decades of sustained effort (Paus, 2014, 2020). So, to keep growing and increasing complexity, countries must embark on intense productivity growth processes to compensate for the cost pressures, but it is unfeasible to sustain that productivity growth with the same products and activities. The countries require deep structural transformations, reallocating resources to more productive activities, to leverage the productivity increase in order to make the increase in general living standards compatible with the international competitiveness of the economy. That could explain the surge – the almost vertical section – in the S-diagram that signals the path to development.

In empirical research it is necessary to set a precise (and, so, arbitrary) threshold to define those countries trapped in an MIT. In previous research (Bianchi et al., 2023), we decided to define as trapped those countries that remained at least 40 years (more on this later) within middle-income thresholds, and we applied a relative measure to define middle-income thresholds, that is, between 10% and 55% of the USA's per capita income (Woo et al., 2012).[2] The objective was to detect countries that failed to overcome middle-income levels along a historically relevant period, determining those levels by using a historical dynamic measure, that is, a relation to the leader economy.

Applying this definition, table 1 shows the countries in the MIT, along with the length of time they have spent there (the maximum is 47 years, because that is the time span considered).

Table 1 – *Middle-income countries according to number of years within 10%<CUI<55%, 1971-2017*

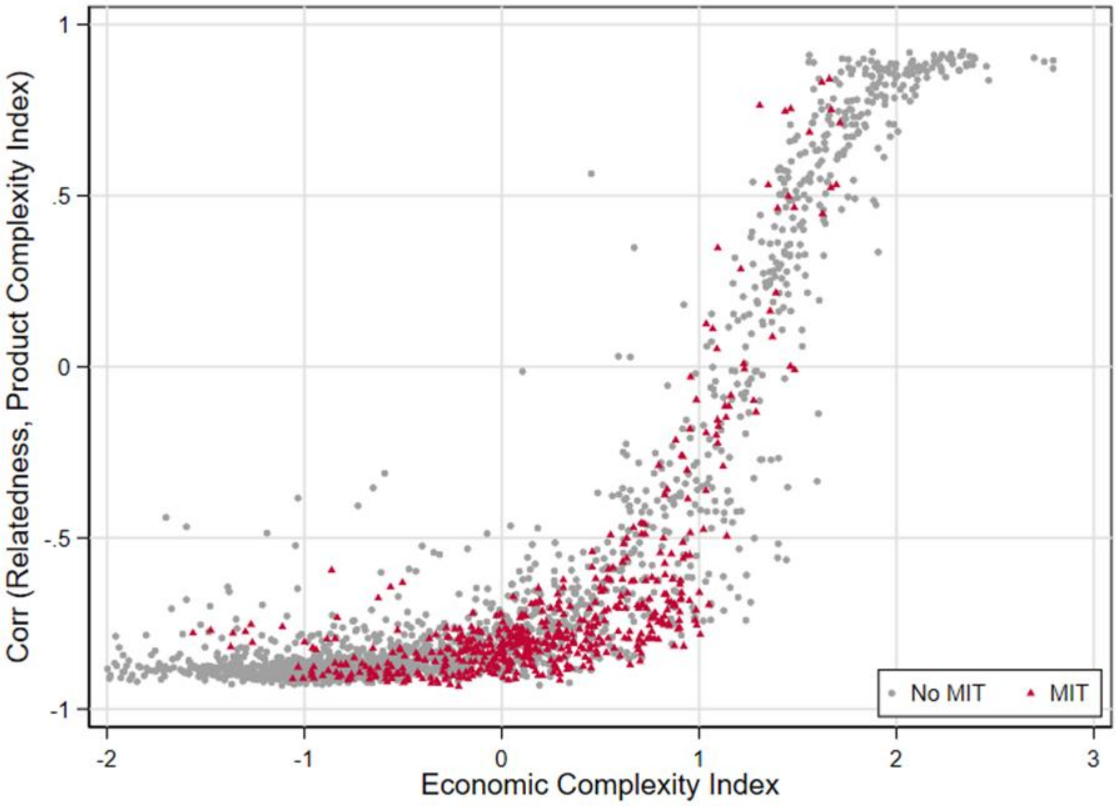
Country	**Years in: 10%<CUI<55%**	**Country**	**Years in: 10%<CUI<55%**
Algeria	47	Mexico	47
Argentina	47	Panama	47
Brazil	47	Peru	42
Chile	47	Poland	47
Colombia	47	Portugal	47
Costa Rica	47	Romania	47
Dominican Republic	47	South Africa	47
Ecuador	47	Thailand	42
Guatemala	45	Tunisia	47
Greece	44	Turkey	47
Hungary	47	Uruguay	47
Malaysia	47	Venezuela	47

Source: Bianchi et al. (2023).

[2] The World Bank defines, in 2023, middle-income countries as those with a per capita GNI between $1.086 and $13.205. The United States´s per capita GNI was more than $77.000 in that year. Using the Woo et al. (2012) lower threshold of 20%, no middle-income country would be considered, according to World Bank criterion. That is why we use here the lower threshold of 10%.

Considering table 1, we may wonder if there is any common structural feature among these countries in the MIT. Figure 4 suggests there is.

Figure 4 – *MIT countries in the ECI – Rho plane*



Source: Bianchi et al. (2024a).

Figure 4 shows the same representation as previous figures, but here the dots corresponding to trapped countries, according to the previous definition, are shown in red. As can be seen, most country/time dots tend to cluster to the left of (and below) the "high step of development", reinforcing the idea that this area can represent the MIT. In fact, the sparse red points climbing that high step correspond to countries that seem to be leaving the trap, given their per capita income, like Hungary, Portugal and Malaysia.

How does this explanation link to heterodox literature? The literature has focused on structural conditions to explain the MIT. This is mainly from the supply side, and it is clearly associated with the idea of productive complexity, where the emphasis is on the lack of capabilities to engage in sophisticated sectors (Paus, 2014, 2020; Hartman et al., 2021; Pinheiro et al., 2022). However, Bianchi et al. (2023) focused on the demand side. The idea is that the MIT is related to a cost increase not validated by demand through export prices. On the basis of this idea, and building on the concept of external restriction, from which a country whose external demand does not grow at the necessary trend to avoid a sustained increase in current account deficit will eventually fall into an external crisis that puts an end to GDP growth, they propose the following indicator, called the export margin:

$$\frac{P_{\exp}}{P/E}$$

where $P_{\exp}$ refers to the average export price, P means average internal price, and E refers to the nominal exchange rate. The export margin is just a simple relation between export prices and internal production costs expressed in the same currency, and it seeks to synthesize the external conditions for standardized exports. The hypothesis is that trapped countries depend on external conditions to grow, while advanced or fast-growing countries (that is, not trapped ones) can grow despite external conditions, based on productivity increases and product differentiation. Note that this set of explanations, from the supply and demand side, coincides with the two sides of the double constraint on competitiveness previously mentioned as characteristic of the MIT: a cost increase associated with an improvement in the standard of living of most of the population, very close to the last demand-side explanation; and a lack of capabilities to engage in sophisticated-sector production, exactly the same as the supply side explanation mentioned.

To test the hypothesis, a specification was proposed in which per capita GDP growth is a function of export margin, differentiating between MIT and non-MIT countries:

$$\Delta GDP_{pc\,it} = \beta_0 + \beta_{nm}.margin_{it-1}(1 - MIT) + \beta_{mit}.margin_{it-1} * MIT + \beta_x.X_{it} + \tau_i + \varepsilon_{it} \qquad (1)$$

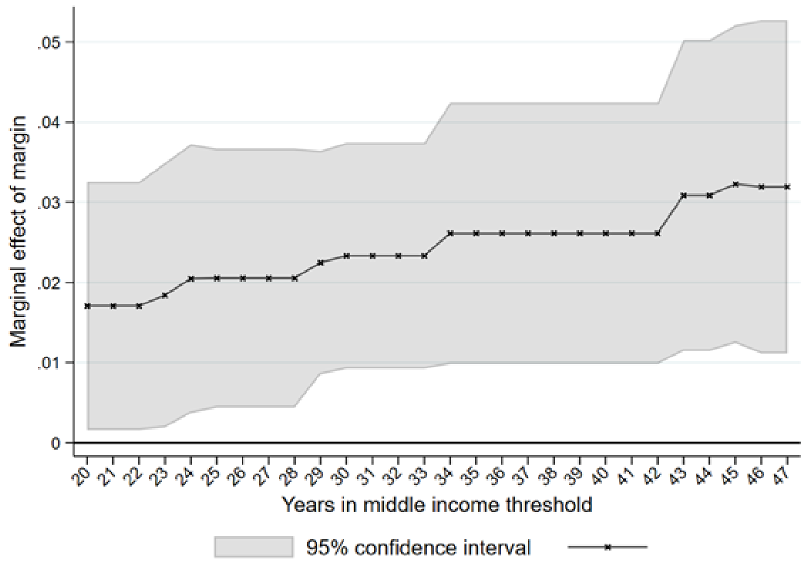
In this expression, MIT is a dummy variable with value 1 if the country falls within the definition of MIT and 0 otherwise; X refers to control variables, and τ_i represents time-controls. The hypothesis would be verified if β_{nm}=0 and β_{mit}>0, signaling that, while MIT countries depend on external conditions to grow, advanced and fast-growing countries do not. In that case, a difference in the macroeconomic working between MIT and non-MIT countries would be unmasked.

The specification was tested using a panel data model with fixed effects (see table A1 in the appendix for a description and the source of variables), and robustness checks were conducted using a dynamic GMM specification, always with data for the period 1971-2017 for all medium- and high-income countries from Penn World Tables 9.1 (Feenstra et al. 2015). (see table A2 in the appendix for the complete list of countries used in the regressions). The results can be summarized in figure 5.

Figure 5b shows the marginal effect of the export margin on growth for non-MIT countries (β_{nm}), where it can be seen that it was never different from zero. Figure 5a shows the same effect for MIT countries; not only it is always significant but also that the longer the stay within the middle-income threshold required for the countries to be considered MIT (what is measured on the horizontal axis), the more significant the effect. That is why a period of 40 years within that threshold is required for countries to be considered as MIT, to have a clearly differentiating criterion.

Figure 5 – *Marginal effect of "margin", according to the time interval required in middle-income thresholds to be considered as MIT*

5a



5b

Source: Bianchi et al. (2023).

In a subsequent step, the possibility of interactions between supply and demand factors were considered (Bianchi et al., 2024a). This means that demand restrictions (the degree of dependence on external conditions to grow) may be stronger, the less complex the productive structure is.

These possible interactions mean that supply and demand are not independent factors and that they influence each other. The dependence on exogenous external prices is far more common in countries exporting simple and standardized products, because the countries exporting sophisticated products face less price competition and have more power to differentiate their products and set their prices; they can access more dynamic demand niches and escape to what the margin indicator can capture.

The hypothesis was that increases in productive structure complexity relax the demand restriction. To test this, the following specification was proposed:

$$\Delta GDP_{pc\,it} = \beta_1 . margin_{i,t-1} . (1 - MIT_i) + \beta_2 . margin_{i,t-1} . \mathrm{MIT}_i + \beta_3 ECI_{i,t-1} + \beta_4 ECI_{i,t-1} * margin_{i,t-1} * MIT_i + \beta_5 ECI_{i,t-1} * margin_{i,t-1} * (1 - MIT_i) + \beta_6 . Rho_{i,t-1} + \vec{\beta} . \vec{X}_{i\,t} + \varepsilon_{it} \quad (2)$$

In this specification, the first two terms are the same as in equation (1), trying to capture the demand restriction; the third term includes the (lagged) ECI of the country to assess complexity effect independently; and the fourth and fifth terms are the main interest, because they try to capture the interactions or the joint effect of supply (ECI) and demand (margin) components separately for MIT and non-MIT countries. So, the fulfilment of the hypothesis would require β_4<0, expressing that, even in MIT countries, an increase in complexity would relax the dependence on the margin to grow. β_5 is expected not to be significant, given that non-MIT countries do not depend so much on external conditions. Table 2 shows the results, and table A1 in the appendix explains all the variables used.

The two first rows of table 2 confirm previous findings about the different importance of external conditions for growth in MIT and non-MIT countries. The third row verifies the importance of productive complexity (supply side). The fourth and fifth rows confirm the hypothesis of interactions between demand and supply factors and their different relative importance for MIT and non-MIT countries. For MIT countries, this is a strongly significant effect, where the negative sign is interpreted in the sense that the higher the ECI, the less important export margin is for growth. This gives rise to the idea that there may exist MIT varieties, that is, different trapping situations within MIT countries (Bianchi et al., 2024a). For non-MIT countries, that effect is much weaker, which is consistent with the lesser importance of external demand conditions for these countries.

The sixth row of table 2 tests the direct impact of unrelated diversification (the Rho indicator previously explained) on growth. And, perhaps surprisingly, it appears not to have a positive effect; what is more, it has a significant negative effect. Does this mean that structural change is not important to sustain growth? No. We interpret, in the same sense as previous authors (Saviotti and Frenken, 2008), that unrelated diversification is essential to sustain growth in the long run, but it acts indirectly through complexity. That is, unrelated diversification supposes an important effort for economies, which are exposed to likely failed bets. In that sense, and as seen in previous sections, it is indispensable if, and only if, it sustains complexity increases, especially at intermediate complexity levels. But then, its indirect impact is evident only in the medium to long run. That time lag supposes economic and political challenges, as will be mentioned later.

In conclusion, it seems that the MIT is caused by supply and demand factors, as well as by their interactions. In the next section, a particular trapping situation is considered.

Table 2 – *Fixed and dynamic GMM models with fixed effects by country. Dependent variable:* $\Delta GDPpc_{it}$

Variables	Fixed Effects			GMM		
$\text{margin}_{t-1} * noMIT$	0.011	0.010	0.008	0.011	0.010	0.007
	(1.257)	(1.530)	(1.084)	(1.109)	(1.202)	(0.792)
$\text{margin}_{t-1} * MIT$	0.015**	0.017**	0.016**	0.027**	0.032**	0.030**
	(2.104)	(2.267)	(2.123)	(2.153)	(2.262)	(2.134)
ECI_{t-1}	0.008	0.025**	0.037***	0.020**	0.048***	0.070***
	(1.215)	(2.015)	(2.734)	(2.016)	(3.495)	(5.197)
$\text{ECI} * \text{margin} * \text{MIT}_t$		−0.011*	−0.013**		−0.023***	−0.025***
		(−1.899)	(−2.060)		(−2.953)	(−3.238)
$ECI * margin * (noMIT)_t$		−0.012	−0.012		−0.012*	−0.013**
		(−1.420)	(−1.389)		(−1.842)	(−2.209)
Rho_{t-1}			−0.028**			−0.052***
			(−2.151)			(−2.970)
Crisis_t	−0.010***	−0.010***	−0.011***	−0.011***	−0.011***	−0.011***
	(−4.444)	(−5.114)	(−5.000)	(−4.755)	(−4.711)	(−4.992)
$Investment_{it-1}$	0.053	0.044	0.042	−0.007	−0.012	−0.005
	(1.264)	(1.238)	(1.145)	(−0.108)	(−0.182)	(−0.089)
$Education_{it-1}$	−0.001	−0.002	−0.001	−0.003	−0.007*	−0.004
	(−0.600)	(−1.112)	(−0.530)	(−0.833)	(−1.780)	(−0.920)
${Education_{it-1}}^2$	0.000	0.000	0.000	0.000	0.000	0.000
	(0.245)	(0.470)	(0.348)	(0.084)	(0.850)	(0.621)
Population_{it-1}	0.000***	0.000***	0.000***	0.000	0.000	0.000
	(4.138)	(3.602)	(3.578)	(1.185)	(1.619)	(1.095)
$\Delta\text{GDPpc}_{it-1}$				0.140*	0.129*	0.120*
				(1.942)	(1.815)	(1.741)
$\Delta\text{GDPpc}_{it-2}$				−0.137***	−0.132***	−0.128***
				(−3.125)	(−3.008)	(−2.804)
Constant	0.004	0.008	−0.014			
	(0.200)	(0.512)	(−0.814)			
Observations	855	855	855	793	793	793
R-squared	0.125	0.133	0.143			
Number of countries	58	58	58	58	58	58
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	No	No	No	No	No	No
Periods	15	15	15	14	14	14

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

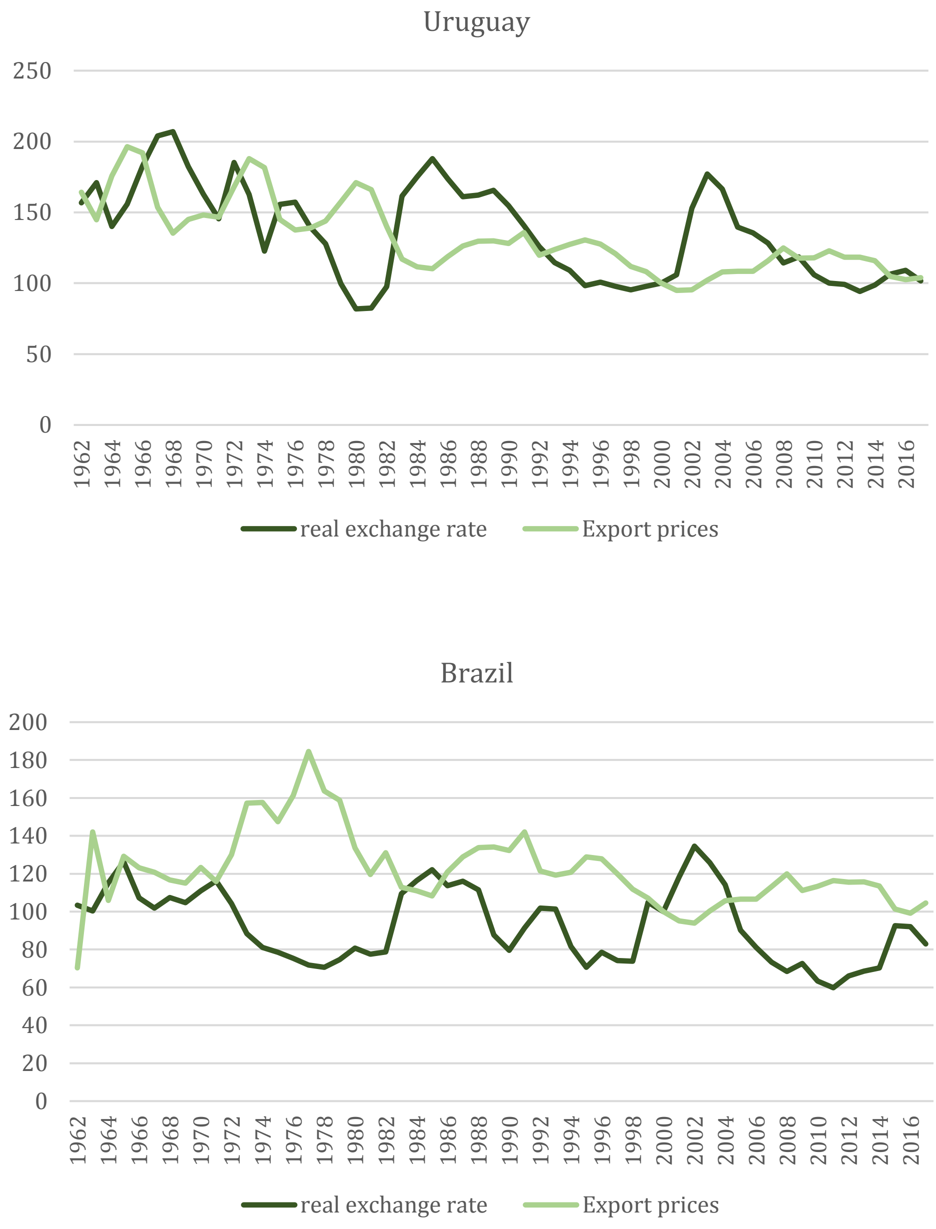
Source: Bianchi et al. (2024a).

3. Commodity dependence as a MIT cause

Most Latin American countries are commodity dependent (UNCTAD, 2019). Commodity dependence encompasses both demand and supply issues: a volatile and undynamic demand on one hand, and very specific productive capabilities, far from most dynamic technological innovations, on the other (Bértola and Ocampo, 2012; ECLAC, 2012; Dosi et al., 2022). But commodity dependence also is the subject of a specific trapping mechanism. This section is about that specific mechanism, which may explain the high prevalence of Latin American countries in the MIT-countries list.

As figure 6 clearly shows for two specific countries, there exists a negative correlation between export (commodity) prices and the real exchange rate (RER) in most commodity-dependent countries.

Figure 6 – *Real exchange rate and export price indexes in Uruguay and Brazil. Year 2000=100*



Source: Own elaboration based on Penn World Table, version 9.1 (PWT 9.1).

Table 3 shows that relationship for all South American countries, the most commodity-dependent region in the world (UNCTAD, 2019).

Table 3 – *South American countries: correlation between export prices and real exchange rate*

	Since 1962	Since 1970	Since 1980	Since 1990	Since 2000
Argentina	–0.53	–0.46	–0.34	–0.55	–0.33
Bolivia	0.58	0.39	0.03	–0.29	0.29
Brazil	–0.36	–0.38	–0.33	–0.51	–0.88
Chile	–0.44	–0.44	–0.26	–0.10	–0.87
Colombia	0.05	0.02	0.07	0.10	–0.88
Ecuador	–0.02	–0.02	–0.06	–0.04	–0.53
Paraguay	0.02	–0.01	–0.12	–0.54	–0.55
Peru	–0.36	–0.33	–0.37	–0.72	–0.52
Uruguay	0.23	0.04	–0.27	–0.16	–0.34

Note: All time-windows finish in 2017.
Source: Own elaboration based on PWT 9.1.

This negative correlation can be easily explained within the framework of a balance of payments constrained growth (BPCG) model, but it requires a quite heterodox (for this literature) assumption, that is, given some balance of payments relaxation, not only adjust the income growth rate, but also the RER (Razmi, 2016). The theoretical model used is a modified version of Thirlwall's (1979) canonical BPCG model (Isabella, 2024) that builds on that of Bianchi et al. (2024b).

The three basic equations are as follows:

$$X = g(\frac{P}{P*E})^{-\gamma} Y *^{\varepsilon} + d\,(\frac{PcomE}{P})^{\alpha} \quad (3)$$

$$M = a\,(\frac{P*E}{P})^{-\Psi}\, Y^{\pi} \quad (4)$$

$$P = (P^{*}E)^{\beta}\, C^{1-\beta} \quad (5)$$

Equation (3) is the exports equation (expressed in real or physical terms), where exports are constituted by two different sectors: a traditional industrial export sector (the first term on the right side of the equation), which, just as in Thirlwall's (1979) model, depends negatively on the relative price of an imported good (with price P* and where E is the nominal exchange rate) and positively on the commercial partners' income level (Y*), and a commodity export sector, which depends positively on the "commodity export margin", the expression between parentheses in the second term on the right side of the equation. It can be seen that the commodity export margin is the same expression as the export margin defined in previous sections; the only difference is that the numerator considers only the commodity prices P_{com}. This last term is the result of assuming some specificities of commodity production and export, like the strong reliance on limited natural resources, the highly competitive nature of most commodity-markets, and the price exogeneity that most exporters face.

Equation (4) is the import equation, the same as in Thirlwall's (1979) model, in which imports depend negatively on their relative prices to local products and positively on local income. Finally, equation (5) is a local price-formation equation, where local prices depend on external prices expressed in local currency (with a weight **β**) and on local non-tradeable costs ("C"; e.g., salaries).

Solving this equation-system requires substituting equation (5) in equations (3) and (4), and then imposing X=M and time-differentiating to solve for y_B, that is, the growth rate compatible with current account equilibrium (equal to the balance of payments equilibrium in this model, where no capital movement is considered). In that way we get to:

$$y_B=\frac{1}{\pi}\quad\{\theta(1+\alpha)p_{com}+[\theta\alpha+\psi+(1-\theta)(\Upsilon-1)](1-\beta)(e-c)-[1-\beta(1-\theta)+\beta\theta\alpha-(1-\beta)[(\psi)-\Upsilon(1-\theta)]p^*+(1-\theta)\varepsilon y^*\} \tag{6}$$

Equation (6) expresses the equilibrium growth rate as a function of exogenous variables (p_{com}, p*, y* and e–c), where lower-case letters refer to time-variation of upper-case ones and θ represents the commodity share of countries' total exports. The last expression inside the parenthesis (e–c) is very important, because it represents RER variations. The letter e is the rate of change of the nominal exchange rate and so of tradable goods, given P*, assuming arbitrage, while c is the rate of change of non-tradable internal costs. The difference (e–c) is then the variation of the relationship between tradable and non-tradable prices, or internal RER (Blecker, 2023).

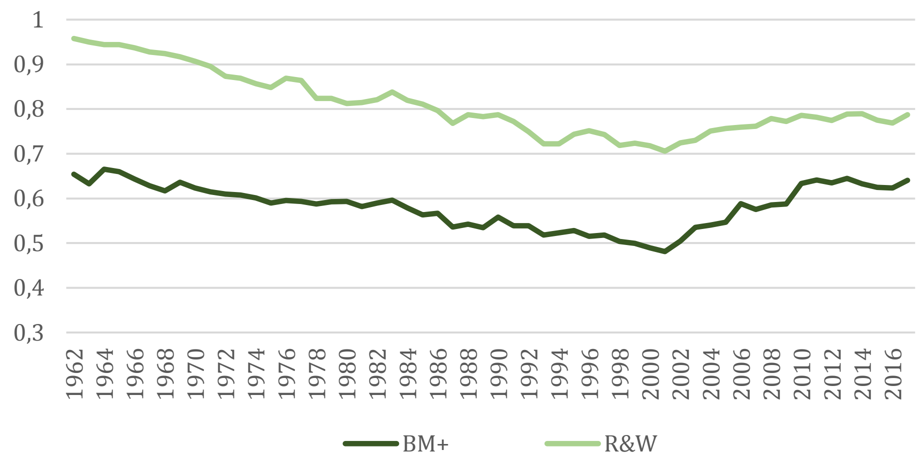
If we solve equation (6) for (e–c) and differentiate with respect to commodity price variations, we get:

$$\frac{\partial(e-c)}{\partial pcom}=-\frac{\theta(1+\alpha)}{[\theta\,\alpha+(1-\theta)(\Upsilon-1)+\Psi](1-\beta)} \tag{7}$$

It can be shown that, given reasonable values of the parameters, equation (7) is negative, meaning that, if we assume that (e–c) is the adjusting variable instead of the growth rate, then an acceleration in commodity prices will provoke a fall in the devaluation rate (eventually a revaluation).

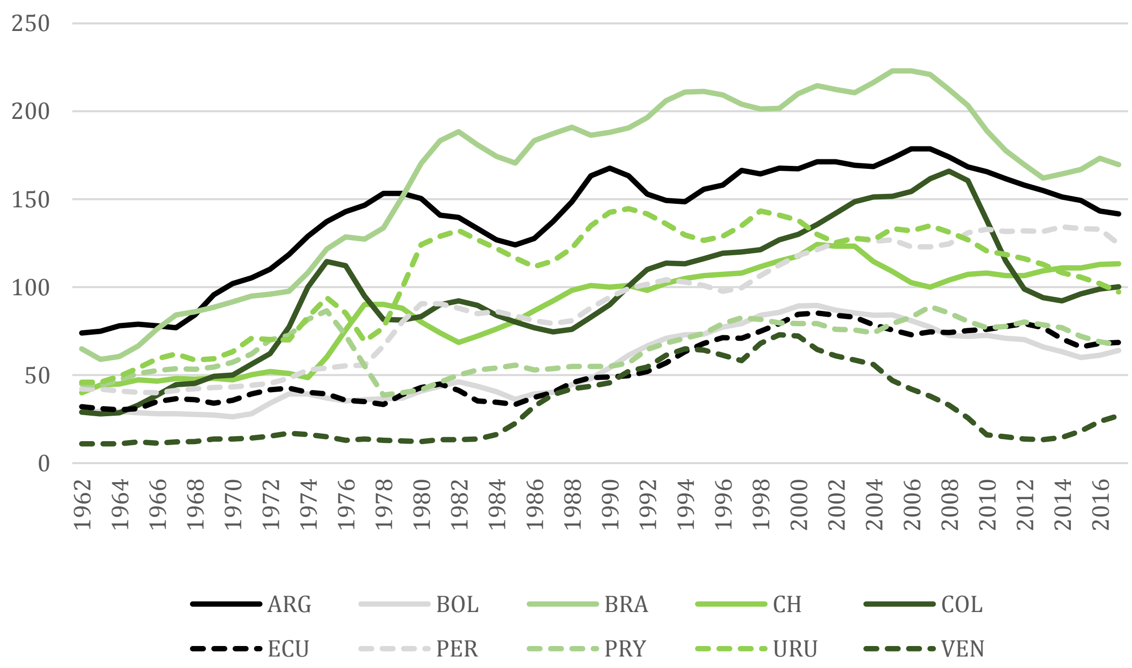
Conceptually, the acceleration in commodity prices increases foreign exchange inflows, which relaxes the external constraint. However, if production cannot respond rapidly enough to accelerate growth, increasing imports to fill the external positive gap (given that growth is the consequence of real-side economy processes, like investment and production, which require time), the abundance of foreign currency will exert downward pressures on the exchange rate. Commodity exports will not suffer the RER deceleration, because they will be benefitting from the price hike, but other export sectors will indeed suffer. In that way, the commodity specialization will be reinforced, in a kind of "Dutch Disease" (Bresser-Pereira, 2008, 2019). But we argue that this specific situation, a kind of "commodity-trap", is, in fact, worse than the traditional Dutch Disease, because the latter is a transition to a new equilibrium associated with the presence of a new export sector. In the commodity trap case, it is a recurrent situation, unleashed with each new commodity boom. Given the volatility of commodity prices, that recurrence may generate a hysteresis situation, because productive capabilities, built through cumulative learning processes, are eroded during price boom phases and are not fully regained during downturns, resulting in progressive productive impoverishment (Cimoli and Porcile, 2015).

Figure 7 – *Commodity share of South American exports*



Source: Author's elaboration based on The Atlas of Economic Complexity (Hausmann and Hidalgo, 2011) and Radetzky and Warrell (2021).

Figure 8 – *Export diversification in South America countries*



Source: Author's elaboration based on the The Atlas of Economic Complexity (Hausmann and Hidalgo, 2011).

Figure 7 and figure 8 show that, as a consequence of the last commodity boom in South America (2002-2012), commodity dependence has increased, and there has been a fall in export diversification (measured by the number of different products exported, with revealed comparative advantage by countries in the region); this suggests that the increase in the commodity share of exports goes beyond a simple price effect.

This mechanism can help to understand the special difficulties that commodity-dependent countries face to increase their complexity and climb the high step of development. In this way, structural change, the middle-income trap, and commodity dependence are deeply intertwined.

4. Conclusions

In this paper, I reviewed some emerging approaches to a traditional development agenda, and I particularly tried to show how different development approaches, originating in heterodox literature, are intertwined. The departure idea is that development is an increasingly complex process, which requires not only productive changes but also a deep redefinition of the role of the country in the international division of labor. Applying tools from the economic complexity approach, and in light of the historical trajectories of old and recent catch-up countries, as well as failed development experiences, it is possible to conceive of economic development as the parallel advance in complexification of the productive structure, along with a move across the PS towards its dense core, that is to say, unrelated diversification to increase future complexification options, also called structural change.

During that transformation process, increasingly complex challenges have to be faced. Particularly at medium complexity levels, a special trap arises, known in the literature as the MIT, associated with the double constraint that countries face: they cannot continue competing in industries associated with simple products because previous growth has unleashed several cost increases, but neither can they engage in highly sophisticated sectors, because they lack the necessary capabilities. Those capabilities are necessary to engage in extremely difficult processes of unrelated diversification, needed to access sectors with low connections to the previous production trajectory. The MIT, then, can be thought of as the difficulty of climbing the "high step of development", represented by the almost vertical section in the relation between the ECI and structural change — that is, the difficulty of sustaining structural change even when it does not have an immediate impact on growth. Aside from the intrinsic difficulties of building new capabilities for new activities, and the risk of failed productive bets, efforts will not be rewarded in the short run by faster growth and increasing income. Thus, transformation success also requires long-run planning and strong political coalitions to support and sustain the effort. That may help to explain why successful transitions from middle- to high-income levels are so infrequent.

Empirically, the detection of trapping situations requires the definition of long enough time spans during which countries are not able to overcome some defined middle-income threshold. Empirical tests suggest that the full configuration of the entrapment situation requires a country to have spent at least 40 years between those thresholds (between 10% and 55% of USA per capita GDP in the exercises shown here).

That conceptualization of the MIT allows us to look for structural specificities of trapped countries. One of the specificities detected was the strong dependence on external conditions to grow. That is, MIT countries are not necessarily stagnant but their growth is not based on sophisticated capabilities that allow them to differentiate their products or permanently increase their productivity; it is based on exceptional demand conditions. In testing this idea, an indicator called the export margin, which compares export prices with internal costs, was shown to be relevant for growth for trapped countries but not for advanced or fast-growing ones. But there also are interactions between demand and supply factors, meaning that demand restrictions that countries face are stronger the less complex their productive structure.

The list of MIT countries shows a very high prevalence of Latin American countries, where commodity dependence is a common feature. Those two facts are intimately intertwined. Commodity dependence encompasses both demand and supply characteristics that make countries especially prone to fall into the MIT. But there is also a specific trapping mechanism that affects commodity-dependent countries, a kind of "commodity trap" associated with the capabilities erosion generated by the RER instability consequence of commodity-price volatility. In that way, complexification becomes especially difficult for countries with this particular specialization, condemning them to remain in the trap.

Appendix

Table A1 – *Variables for econometric estimations*

Variable	Definition	Source
	Dependent variables	
ΔGDPpc$_{it}$	Growth of GDP per capita (supply side), country *i*, year *t* $(\Delta GDPpc_{it}/GDPpc_{it})$	Bianchi et al. (2023), based on PWT 9.1
	Explicative variables	
MIT_{it}	Dummy variable, takes value 1 if the country falls into MIT definition, 0 otherwise. A country is considered trapped in MIT if it was at least 40years within the thresholds $CUI_{it} \in [10\%; 55\%]$.	Bianchi et al. (2023), based on PWT 9.1
$margin_{it}$	Export margin, country *i*, year *t:* $\dfrac{\dfrac{nominal\ exchange\ rate\ i,t\ *\ Export\ price\ index\ i,t}{Consume\ price\ index\ i,t}}{\dfrac{nominal\ exchange\ rate\ US,t\ *\ Export\ price\ index\ US,t}{Consume\ price\ index\ US,t}}$	Bianchi et al. (2023), based on PWT 9.1
ECI_{it}	Economic Complexity Index: ranking of countries based on how diversified and complex their export basket is in time t	Atlas of Economic Complexity
Rho_{it}	Corr $_{it}$ (density$_{ipt}$*PCI$_{pt}$), t= year; i=country; p=product; PCI = Product Complexity Index	Authors, based on Atlas of Economic Complexity
	Control variables	
GDPpc$_{i1}$	Real GDP per capita (supply side) of country *i*, year 1 (initial year of the period covered); thousands of dollars	PWT 9.1
$Investment_{it}$	Investment share of GDP, country *i* in the year *t*	PWT 9.1
$Education_{it}$;	Average years of education, population country *i*, year *t*	World Bank
$Education_{it}^2$;	Square of average years of education, population country *i*, year *t*	World Bank
$Crisis_{it}$	Dummy variable. Takes value 1 if there was an economic or financial crisis in country *i*, year *t*.	Bianchi et al. (2023), based on *Global crisis data*
Population$_{it}$	Million inhabitants, country *i*, year *t*	PWT 9.1

Table A2 – *Countries used in the regressions*

Albania	Algeria	Angola	Arab Rep.	Argentina
Armenia	Australia	Austria	Azerbaijan	Belarus
Belgium	Bolivia	Bosnia and Herzegovina	Botswana	Brazil
Bulgaria	Canada	Chile	China	Colombia
Costa Rica	Croatia	Czech Republic	Denmark	Dominican Republic
Ecuador	Egypt	El Salvador	Finland	France
Georgia	Germany	Greece	Guatemala	Hong Kong SAR
Hungary	India	Indonesia	Iran	Islamic Rep.
Iraq	Ireland	Israel	Italy	Jamaica
Japan	Jordan	Kazakhstan	Korea Rep.	Kuwait
Kyrgyz Republic	Lao PDR	Lebanon	Lithuania	Malaysia
Mexico	Moldova	Mongolia	Morocco	Myanmar
Namibia	Netherlands	New Zealand	North Macedonia	Norway
Oman	Panama	Paraguay	Peru	Philippines
Poland	Portugal	Qatar	Romania	Russian Federation
Saudi Arabia	Serbia	Singapore	Slovak Republic	Slovenia
South Africa	Spain	Sri Lanka	Sweden	Switzerland
Taiwan	Thailand	Tunisia	Turkey	Ukraine
United Arab Emirates	United Kingdom	United States	Uruguay	Venezuela RB
Vietnam				

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