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The Profit Rate in Chile: 1900-2010

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Abstract

The interest of this paper is to discuss the main features that characterize the accumulation regimes that have taken place during the twentieth century in Chile. Understanding that a set of institutionalized compromises and political conflicts are inherent to any capitalist society, I rely on the body of literature of Marxist political economy, which focuses on the dynamics of profitability to describe its reproductive patterns. In light of this analysis, I argue that the main institutional transformations in Chilean history are better understood. I characterize long-waves of capitalist accumulation as accumulation regimes and identify three stages: early expansion, late expansion, and crisis. Using decomposition analysis, I identify recurrent patterns in each phase and also argue that the distributional conflict is historically contingent. Moreover, I implement a novel method proposed by Shaikh (2016) to identify the utilization rate, which allows me to discuss issues of aggregate demand in the decomposition analysis more accurately. Furthermore, I also discuss the relation of the process of urbanization with technical change relying on the Okishio-Marx debate. Finally, I argue that unlike previous accumulation regimes, the neoliberal period relies on reproductive patterns of profitability that makes it highly stable.

JEL Codes: *B51, B52, E11*

Key Words: *Profit Rate, Accumulation Regimes, Economic Growth*

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1 Introduction

The Marxian tradition of political economy understands capitalism as a system driven by the needs of capital accumulation. Given that profitability is the primary driver of capital accumulation, the aggregate profit rate is one of the critical variables for Marxian political economy analysis. Hence, Marxist economists pay close attention to movements in protability to explain key macroeconomic events and institutional transformations (Basu, 2013).

The use of Marxist economic analysis has seldom explored by researchers to understand Chilean society. None of the available contributions (Piñera and Meller, 1972; Maito, 2012) on this framework have engaged with the vast body of Marxist research produced by the Anglo-Saxon academy.[1] The motivation of this paper is to begin a research agenda on this respect. Therefore, to identify the long-waves of capitalist accumulation and its correspondent accumulation regimes have been chosen as the starting point to discuss Chile's economic development from a Marxist perspective.

Consequently, I study the dynamics of profitability over the 1900-2010 period to identify key economic developments and the main institutional transformations of Chiles contemporary history. Using decomposition analysis, I identify the reproductive patterns of profitability to discuss the stability/instability of the accumulation regimes. To do so, I exploit time series available in the Economic History Cliometrics-LAB of the Pontifical Catholic University (PUC).

The structure of this paper is as follows. First, I develop an analytical framework where the relevance of profitability analysis and its decomposition is discussed to understand accumulation regimes. Moreover, I present a novel co-integration method to identify the utilization rate, which allows discussing issues related to aggregate demand more accurately. Second, I discuss the data sources of this paper and different measures of profitability given the available data in the CLIO-LAB data set. Third, I present the empirical results. Finally, the paper concludes.

[1] Basu (2017) presents a comprehensive survey of quantitative research done in a Marxist political economy framework.

2 Analytical Framework

The interest of this paper is to discuss the main features that characterize the accumulation regimes that have taken place during the twentieth century in Chile. Understanding that a set of institutionalized compromises and political conflicts are inherent to any capitalist society (Boyer, 2001), I rely in the body of literature of Marxist political economy which focuses on the dynamics of profitability to describe critical developments of capitalist economies.

Jessop (1997) defines an accumulation regime as a complementary pattern of production and consumption, which is reproducible over a long period. Furthermore, Julliard (2001) argues that distribution and technical change are central to the reproduction of an accumulation regime. Two channels through which distribution reproduces profitability highlight. On the one hand, capital accumulation is partly determined by the profit share, given its effects on the return of future investments. On the other hand, different demands created by different types of incomes have consequences in aggregate demand and consequently in growth dynamics. The author also discusses how innovation and returns to scale, which define capital productivity and hence, profitability, are dependent on institutional arrangements. Returns to scale are particularly relevant for peripheral economies as Chile, not only in firms extending their operations but also because of the gains in capital productivity given by improvements at the level of communications networks, infrastructure for transportation, and the degree of urbanization.

Profitability analysis allows identifying key developments of an accumulation regime and its reproductive patterns. Basu (2017) presents a comprehensive survey of quantitative Marxist political economy and gives a complete review of the particular body of literature which focuses on profitability analysis. This research describes key developments of capitalist economies focusing in short or medium run temporal movements in the profit rate. Moreover, changes in its underlying components are used to explain the link between profitability and structural crisis of capitalism.

To identify each accumulation regime for the 1900-2010 period, I follow a peak and through analysis identifying three stages: early expansion, late expansion, and crisis. Early expansion is considered as the phase when a rising profit rate takes place until

it reaches a peak. For late expansion is considered the period between a peak of the profit rate until a peak of output-capital ratio. Phases of crisis are defined from a peak of output-capital ratio to the following through of the profit rate. Identifying periods of early expansion, late expansion, and crisis, statistical and decomposition analysis at a medium-run or short-run will deliver more interesting insights.

Medium-run decomposition analysis abstract from fluctuations in aggregate demand. Hence, to analyze the drivers of profitability, a decomposition of the profit rate into profit share and the output-capital ratio is used.

$$r = \frac{\Pi}{K} \tag{1}$$

$$r = \frac{\Pi}{Y}\frac{Y}{K} \tag{2}$$

$$r = \pi\delta \tag{3}$$

Where π is the profit share and δ is the output-capital ratio.

An advantage of this decomposition is that it identifies the reproduction of profitability through the dynamics of inequality (profit share) and technical change (capital productivity). Hence, it reduces into two components the drivers of capital accumulation simplifying the analysis about the stability/instability of an accumulation regime. A disadvantage of medium-run analysis is that it does not consider the role of aggregate demand. However, a three-part decomposition adding capacity utilization solves this issue. Letting Y^* refer to capacity-output, the three-part decomposition originally prooposed by Weisskopf (1979) can be written as.

$$r = \frac{\Pi}{K} \tag{4}$$

$$r = \frac{\Pi}{Y}\frac{Y}{Y^*}\frac{Y^*}{K} \tag{5}$$

$$r = \pi\mu\sigma \tag{6}$$

Thus, the role of distribution (profit share), demand (capacity utilization), and technology

(capacity-capital ratio) in the reproduction of profitability can be analyzed. To implement this analysis is necessary to identify somehow capacity-output to calculate both capacity utilization and capacity-capital ratio. This issue is discussed in detail below.

In both medium and short-run analysis, each of the three terms in the decomposition can be decomposed into sub-components for further, and detailed study. For example, output-capital ratio can be decomposed into labor productivity and technical composition of capital as follows.

$$\frac{Y^*}{K} = \frac{Y^*}{L} / \frac{K}{L} \tag{7}$$

As previosuly mentioned, the problem of short-run analyisis is that requires the estimation of a non-observed variable which is the economic capacity Y^* to identify both capacity utilization rate and the capacity-capital ratio. Shaikh (2016, p. 822) discusses four groups of measuring economic capacity. First, there is a group of measures which consider the economic capacity as a long-run trend of real output. Therefore, to use an HP filter might allow to identify the tendency of real output and separate it from its cyclical component. Two problems arise from using an HP filter. On the one hand, the trend not necessarily represents the path of normal capacity utilization. On the other hand, it builds a symmetric cycle misrepresenting actual deviations from the trend. Another option is to estimate capacity directly using a Wharton Method. This method assumes that except for short-run downturns capitalist economies operate at normal capacity. Thus, the peak in each business cycle identifies it. However, this method has two caveats. It excludes medium-long run variations in capacity utilization and rests in the neoclassical assumption that the economic system operates a full capacity. Second, there is a group of measures used by the Bureau of Economic Analysis and the Bureau of Census which relies on surveys of operating ratios. These do not define explicitly what is economic capacity, so firms are free to choose between different measures to report. Regressions techniques are used to smooth it using regressions on capital stocks and time, which makes them not trustworthy. Moreover, it is an aim of the method to measure capacity utilization without being chronically bellow normal capacity also assuming that economic system operates at full capacity utilization. Third, a group of measures used by the IMF

and OECD which estimates potential output using a fitted production function. Using a labor input defined by a natural rate of unemployment and a capital input defined by the trend level of total factor productivity potential output is estimated. From a heterodox perspective, this method is problematic because it relies on the notion of aggregated production function and the existence of a natural rate of unemployment. Fourth, is the group of measures which directly measure the rate of capacity utilization for example, measuring the utilization rate of the electric motors used to drive capital equipment. This method presents the obstacle of having the data on the installed capacity of electric motors.

To avois this issues I utilize a novel method proposed by Shaikh (2016, p. 824). As real output Y and capital stock K are known variables we can start from the ouput-capital ratio as follows:

$$\frac{Y}{K} = \mu\sigma \tag{8}$$

$$lnY = lnK + ln\mu + ln\sigma \tag{9}$$

On the other hand, we can define σ as the profit rate at normal capacity. The value that the profit rates takes at full utilization of economic capacity, i.e $\mu = 100\%$. This variable captures the relation between technical change and profitability, so I assume the following process determines it:

$$ln\sigma = \alpha + \beta t + \gamma lnK \tag{10}$$

This process for σ relies on the idea that technological change is defined by an autonomous component represented by β and an embodied capital component represented by γ.

Considering both equations:

$$lnY = \alpha + \beta t + \gamma' lnK + ln\mu \tag{11}$$

Where $\gamma^{'} = 1 + \gamma$. Therefore, we can estimate a cointegration model of two observed variables assuming that the residual of the cointegration relation is $ln\mu$ where the non-observed variable of interest Y^* is underlying. The intuition of this method is that economic capacity is the aspect of output which is cointegrated with capital stock in the long run. Some advantages of this method are that on the contrary to using an HP filter, it does not build a symmetric cycle by construction. Consequently, it identifies booms and depressions more precisely. Moreover, it is not necessary to concern about inflation issues because rising prices will rise output and capital stock independent of their structural relation.

3 Data

The focus of this paper is to study the dynamics of the profit rate:

$$r = \frac{\Pi}{K} \tag{12}$$

Where Π is the flow of profit income over a year, and K is the replacement (current) cost stock of fixed capital at the beginning of the year. To analyze the trend of this variable historically for the 1900-2010 period, the best proxies that I can get from the two variables needed to construct the rate of profit I rely in the CLIO-LAB database (Díaz et al., 2016). The CLIO-LAB data set is a compendium of historical statistics for Chile, which collects historical and cliometricsdata and the period of the whole republic, i.e., 1810-2010.

For the flow of profit income over a year, I use the data on the functional distribution of income available in the data set with nominal GDP. Using the capital share of each year, I multiply this variable with the nominal GDP to get the flow of profits.

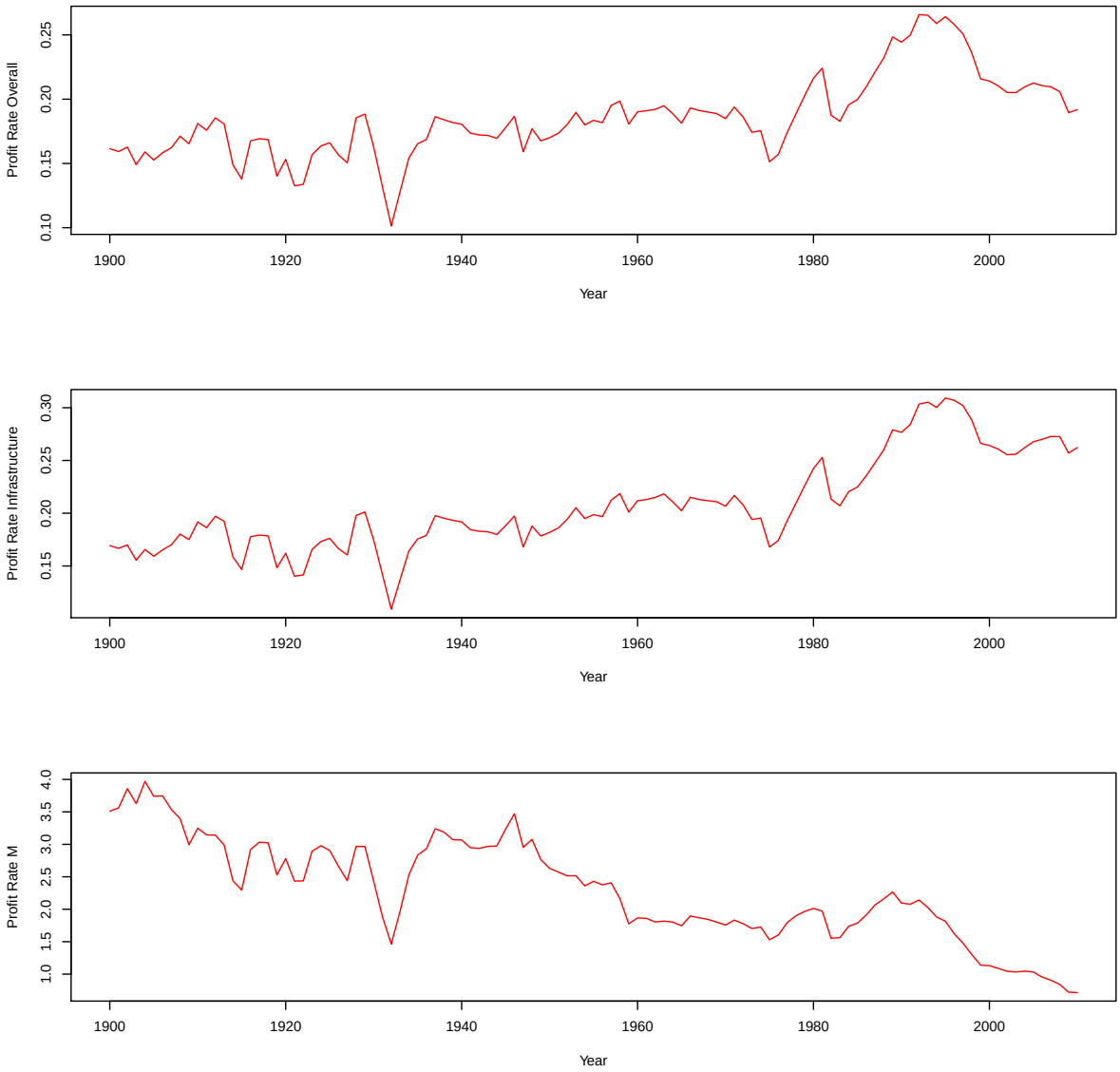
For the replacement cost stock of fixed capital at the beginning of the year, the CLIO-LAB data set provides three measures of capital stock first, a measure of capital stock in machinery. Second, a measure of capital stock in infrastructure; and finally, a measure of total capital stock, which is the sum of both. Ideally, the capital stock needed to measure the rate of profit should not consider residential fixed capital stock. However, it is

impossible to identify in the proportion of capital stock in infrastructure that corresponds to residential and non-residential capital stock.

Elements of the rate of profit should be valued at current prices so that relative price ratios do not distort the rate of profit. (Weisskopf, 1979; Shaikh, 2016, p. 243). Thus, I converted to nominal prices the three series of real capital stock available in the CLIO-LAB data set using a GDP deflator. This give us three measures of the rate of profit that can be appreciated in figure 1.

Ideally, the profit rate that should be preferred is the one associated with machinery, equipment, and productive infrastructure. However, as I mentioned above, there is no way to identify the proportion of infrastructure, which is non-residential in the CLIO-LAB data set. The profit rate for machinery presents an interesting downward trend that is consistent with the Marxian hypothesis of the profit rate to fall. However, the fact that the range of the constructed variable is between 400% and 100% makes it unrealistic as a measure of profitability. Hence, I have decided to realize the analysis of the profit rate, considering the total capital stock.

Figure 1: Profit rate. 1900-2010. Different measures.



Graph (1) Profit rate calculated with total capital stock. Graph (2) Profit rate calculated with infrastructure capital stock. Graph (3) Profit rate calculated with machinery capital stock.

Source: Own elaboration based on CLIO-LAB, PUC

4 Empirical Results

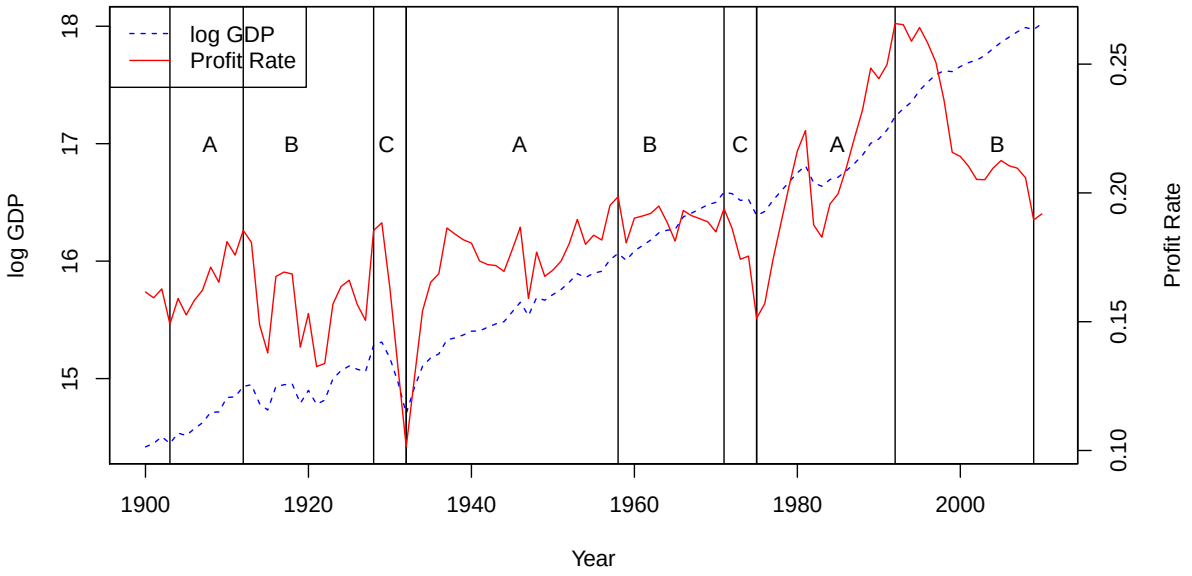
4.1 Growth and Profitability

As other previous accounts identifying accumulation regimes in Latinamerica (Llambí, 1991; Bulmer-Thomas, 2010) the peak-through analysis identifies three accumulation regimes in the 1900-2010 period as can be appreciated in Table 1. The first accumulation regime identified correspond to the pre-industrial export-oriented regime that took place until the great depression. The second accumulation regime corresponds to an inwardly-oriented import substitution industrialization regime. Finally, the third accumulation regime corresponds to the post-industrial externally-oriented export/import diversification regime also known as neoliberal period.

Table 1: Accumulation Regimes

	Early Expansion (A)	Late expansion (B)	Crisis (C)
I	1903-1912	1913-1928	1929-1932
II	1932-1958	1959-1971	1972-1975
III	1976-1992	1993-2008	2009-2010

Figure 2: Profit Rate and log Real Output. 1900-2010



Source: Own elaboration based on CLIO-LAB, PUC

Figure 2 plots the profit rate, together with real output in log terms. For the first accumulation regime, the peak-through analysis identifies an early expansion phase for the period comprehended between 1903 and 1912 where the expansion of the nitrates industry would explain a steady path of the profit rate and economic growth. On the contrary, the late expansion phase over the 1913-1928 period shows a more turbulent path of economic growth and profitability. External and internal issues play a part to explain this period of instability. The explosion of world war 1 had severe repercussions for the nitrates industry (Bulmer-Thomas, 2010); meanwhile, the ongoing crisis of the hacienda system turn into the crisis of the oligarchic republic and definetly collapsed when the great depression came into place. The effects of the crisis come clear in the phase of structural crisis over 1929-1932 with the collapse of the profit rate.

For the second accumulation regime, the analysis identifies an early expansion phase from 1932 to 1958. Over this period is when the process of capitalist restructuring takes place to restore profitability aligning the interests of landlords and bankers around the process of state-led industrialization (Silva, 2007). State companies and industrial manufacturers relied on surplus labor and subsidizes, which established a friendly environment for business with a stable path of profitability and hence, economic growth. The late expansion phase from 1959 to 1971 is characterized by the continuation of the import substitution industrialization (ISI) policies but with a strong presence of social mobilization. Over the so-called long-sixties the industrial working class, squatters, and peasants starred the political scenario showing the failures of the ISI model for the vast majority of Chileans (Loveman, 1976; Thielemann, 2018; Garcés, 2002). Despite the political turmoil, profitability and growth remain relatively stable until a structural crisis came into place.

The peak and through analysis identifies as a phase of early expansion the period 1976 to 1992. At the beginning of this period is when shock therapy policies were applied in Chile and over the 80s when privatizations and other policies of structural adjustment took place in over Pinochet's dictatorship (Leiva, 2008). As can be appreciated in figure 1 despite its rising trend, the path of profitability was highly unstable, which is consistent with low economic growth due to the debt crisis and structural adjustment policies (Bulmer-Thomas, 2010). Late expansion takes place over 1993-2008, covering most of the post-dictatorship period. Through this period profitability presents a stable downward trend

alongside a dynamic pace of capital accumulation. Economic growth was particularly high at the beginning of this period and slowed down in the aftermath of the Asian crisis. The distinction between early and late expansion over the same accumulation regime is similar to the distinction made previously by Agacino (2003) who differentiate the dictatorship and post-dictatorship as infant versus mature neoliberalism. Finally, the period 2009-2010 is when the global crisis came into place. However, the application of counter-cyclical policies by Michelle Bachelet's governement alleviated its effects making it a partial crisis without major implications for the accumulation regime.

Table 2 summarizes these dynamic presenting descriptive statistics of growth and profitability. For each accumulation regime, mean and standard deviation are presented for the rate of growth g and the profit rate r. Four periods are considered, the full period of the accumulation regime and also each of its phases: early expansion, late expansion, and crisis.

Table 2: Growth and Profitabiity.

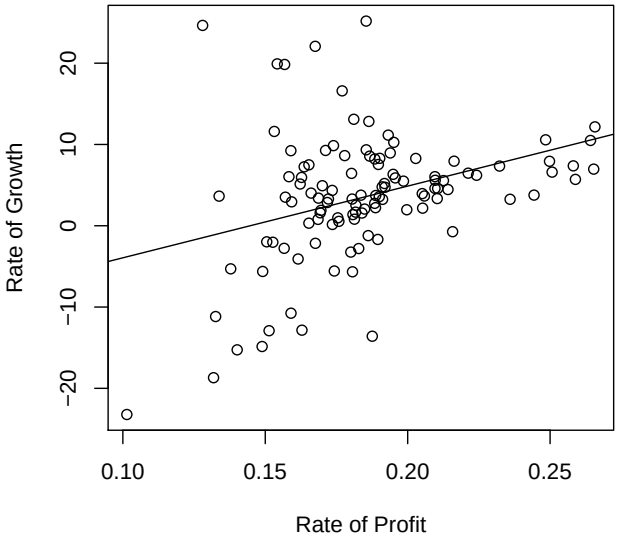
	Full Period		Early Expansion		Late Expansion		Crisis	
A.R.	g	r	g	r	g	r	g	r
I	1.31	15.85	4.53	16.6	2.88	15.7	-13	14.61
	(11.59)	(1.91)	(5.99)	(1.21)	(12.17)	(1.59)	(11.33)	(3.77)
II	4.22	17.92	5.61	17.53	3.77	18.89	-1.95	17.62
	(6.9)	(1.36)	(7.23)	(1.41)	(4.12)	(0.45)	(8.08)	(1.61)
III	4.88	21.75	5.26	21.18	4.88	22.7	1.76	19.07
	(4.58)	(2.78)	(5.98)	(2.99)	(2.5)	(2.38)	(4.86)	(0.17)

Note: Average values. Standard deviation in parenthesis.
g: economic growth (real GDP)
r: rate of profit

A more systematic approach is to control by the linear relation between the rate of growth and the rate of profit and adding dummy variables for each accumulation regime and each phase to see if there are systematic differences. Figure 3 plots the rate of growth and the rate of profit, showing the positive correlation between them. Under a time series setting it is important to discuss the stationarity of each variable before use them in a regression analysis. Table 3 shows that the rate of growth is stationary without a drift nor trend and that the rate of profit is trend stationary. Therefore, the rate of profit cannot be

used in the regression analysis.

Figure 3: Profit Rate and Rate of Growth. Linear relation.



Source: Own elaboration based on CLIO-LAB, PUC

Table 3: Augmented Dicky Fuller Test.
Rate of Growth and Rate of Profit.

	τ	1pct	5pct	10pct	Type
g	-6.41	-3.99	-3.43	-3.13	None
r	-3.73	-3.99	-3.43	-3.13	Trend

Two alternatives to the rate of profit can be used to control by its linear relationship with the rate of growth. First, is its cyclical component extracted with an HP filter which by construction is stationary. Second, is using the change of the rate of profit Δr, which is stationary because r is a $I(1)$ variable. Both alternatives are used to control by profitability and explore if there are systematic differences in the rate of growth by each accumulation regime and phases. Table 4 presents these results. Column (1) shows the regression using the rate of profit which should not be considered but is presented as a benchmark. Column (2) and (3) expose the results of the regressions using the cyclical component of the rate of profit extracted through an HP filter. Column (4) and (5)

present the results of the regressions using the change of the rate of profit.

Regression results show that there is a positive correlation of the rate of profit with the rate of growth which is statistically significant. As previously mentioned, OLS regression between both variables should be discarded because the lack of stationarity of the rate of profit series. However, this result holds for our two alternatives: the cyclical component and the change of the profit rate. Once controlling for the cyclical component of the profit rate, only a dummy variable for phase C (crisis) is statistically significant. This estimated coefficient is -8.49% suggesting that given a profit rate crisis phases have considerable lower economic growth. Results of the dummy variables for accumulation regimes and phases change once the change of the profit rate is used as a control variable. Column (5) shows that in this case, accumulation regime II and III have statistically significant higher growth than accumulation regime I in order of 1.66% and 1.85% respectively. Only the dummy variable for phase B is statistically significant with a value of 2.99% suggesting that in phases of late expansion given the change in the profit rate economic growth is higher than phases of early expansion. On the contrary to the specification using the cyclical component of the profit rate, the dummy variable for phase C is not statistically significant. These results suggest more intuitive conclusions than column (3). First there is a considerable higher R^2. Second, the statistically significative coefficient for the dummy variable of phase B indicates that there are intrinsic factors for phases of late expansion that sustain growth despite changes in the profit rate. Moreover, for phases of crisis, this would not be the case, suggesting that the collapse of profitability is the main driver of economic contractions backing up the Marxist theory of crisis.

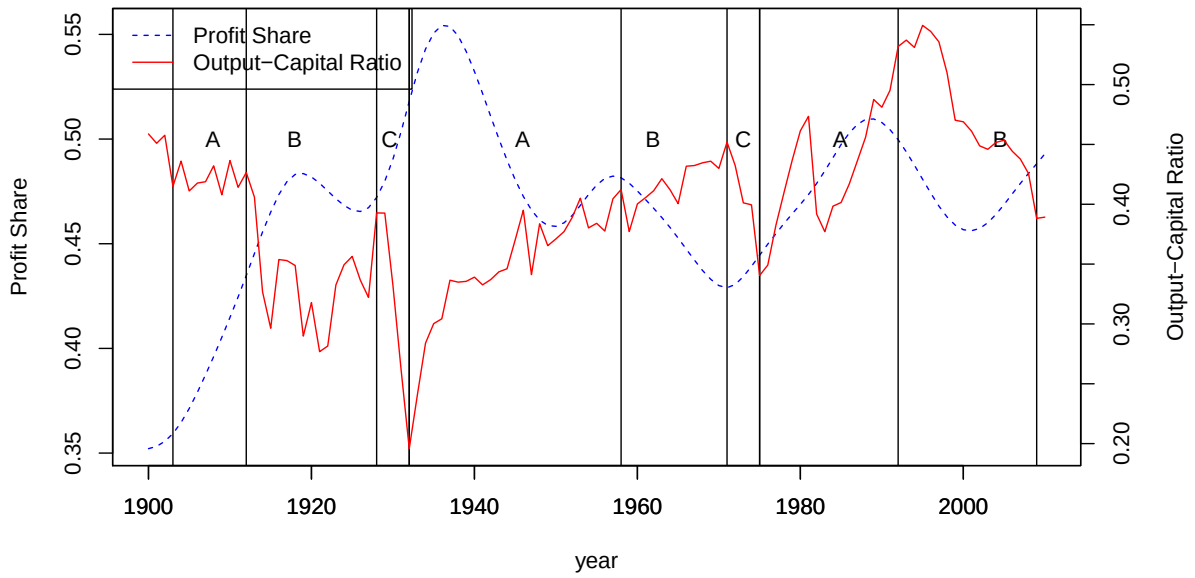
4.2 Decomposition Analysis: Medium Run

Table 5 shows the average annual growth rates for the profit rate and the contribution of each component to it. Figure 4 plots together the profit share and output-capital ratio and identifies the three accumulation regimes. From both we can characterize the reproductive patterns of profitability for each accumulation regime.

Table 4: Growth and Profitability. Regression Analysis.

	Dependent variable: Rate of Growth				
	r	HP Filter		Δr	
	(1)	(2)	(3)	(4)	(5)
r	0.88^{***}	3.29^{***}	3.03^{***}	5.70^{***}	5.67^{***}
	(0.23)	(0.51)	(0.49)	(0.20)	(0.19)
AR II			2.19		1.66^{***}
			(1.55)		(0.58)
AR III			2.57		1.85^{***}
			(1.59)		(0.60)
Phase B			-1.05		2.29^{***}
			(1.33)		(0.51)
Phase C			-8.49^{***}		-0.98
			(2.13)		(0.86)
Constant	-12.77^{***}	3.57^{***}	3.24^{**}	3.49^{***}	1.38^{**}
	(4.31)	(0.64)	(1.43)	(0.26)	(0.54)
Observations	111	111	108	110	108
R^2	0.12	0.27	0.40	0.88	0.91
Adjusted R^2	0.11	0.27	0.37	0.88	0.91
Note:				*p<0.1; **p<0.05; ***p<0.01	

Figure 4: Profit Share and Output-Capital Ratio. 1900-2010.



Source: Own elaboration based on CLIO-LAB, PUC

A decreasing profit rate characterizes the first accumulation regime. Over this period, an increasing path of inequality took place without being able to compensate for the slow pace of capital productivity. Hence, profitability was incapable of reproducing itself in the long run, given the limits to compensate for slow pace capital productivity with higher inequality. The second accumulation regime shows an increasing path of the profit rate explained by a decreasing path of inequality compensated by a more dynamic pace capital productivity. The features of the ISI model would explain this. On the one hand, a state-led industrialization process explains a higher pace of capital productivity. Ont the other hand, the emergence of labor unions around the process of industrialization would explain an increasing strength of labor. A rising profit rate characterizes the third accumulation regime. An average increase in both profit share and output-capital explains the rising path of profitability. The political repression and disciplining measures to the working class applied by the military dictatorship and the high economic growth experienced with the natural resource industrialization over the post-dictatorship period would explain this.

The profit rate decomposition also can be applied through phases of accumulation. Even

Table 5: Profit Rate Decomposition. Medium Run. (all figures in %, represent average annual rates of growth

	Full Period	I	II	III
Profit Rate	-0.17	-2.00	0.69	0.50
Profit Share	0.31	1.29	-0.37	0.27
Ouput-Capital Ratio	-0.48	-3.29	1.06	0.23

though each period presents unique features of the reproduction of profitability in each phase, some conclusions can be drawn from this decomposition. In table 6 can be appreciated that through phase A, when a rising trend in the profit rate takes place, profit share and the output-capital ratio does not present contrary trends. On the contrary, phase B defined by a decreasing path of the profit rate is explained by contrary trends of the profit share and output-capital ratio. An average increase in the profit share is not enough to counteract the slower pace of capital productivity. It is important to recall that this is an average result that not necessarily apply for each phase; for example, this was not the case for the ISI period where an increasing strength of labor took place through its late expansion phase. Finally, crisis phases present similar results to phase B but with a more severe magnitude on the decrease of the profit rate. A decreasing output-capital ratio that cannot be compensated by increases in inequality explains this. This result makes sense considering that periods of economic crisis have regressive effects on the distribution of income and recessive ones on real output.

Table 6: Profit Rate Decomposition by Phases of Accumulation (all figures in %, represent average annual rates of growth)

	Full Period	A	B	C
Profit Rate	-0.17	0.70	-0.12	-2.64
Profit Share	0.31	0.69	0.14	0.77
Ouput-Capital Ratio	-0.48	0.01	-0.26	-3.41

Table 7 presents the analysis for each phase of each accumulation regime. Several insights highlight from these results. First, in each early expansion phase, the rise of the profit rate is explained by an expansion of the output-capital ratio. This rise is not coupled necessarily with rises of the profit share. In the first and third accumulation regimes, there is a positive contribution to the profit share to the profit rate. However, in the second accumulation regime, the profit share has a negative contribution due to a rise in

the strength of labor. These results suggest that a dynamic pace of capital productivity characterizes early expansion phases; meanwhile, the dynamics of the distributive conflict is historically contingent. Second, late expansion phases do not have necessarily an average decrease in the profit rate. As can be appreciated in Table 7, the first and third accumulation regimes present a negative average growth but positive in the second accumulation regime. The underlying dynamic of the output-capital ratio explains these differences: the first and third accumulation regimes present a negative contribution of the output-capital ratio to the profit rate while the second present a positive one. Third, similar features of the crisis phase take place in the first and second accumulation regimes. Albeit a regressive distributive effect presents in both, a sharp fall of the output-capital ratio explains the collapse of the profit rate. On the contrary, the third accumulation regime does not register a negative dynamic of the profit rate rather than a positive one. An increase in both components explains the restoration of profitability in this phase. These results show that crisis phases in the first and second accumulation regime had a structural character what would explain the need for processes of capitalist restructuring to build a new accumulation regime after them. Whereas, the characteristics of the crisis phase in the third accumulation regime of restoration of profitability would explain that there is no need for a process of capitalist restructuring in Chile due the crisis of neoliberalism.

Table 7: Profit Rate Decomposition by Accumulation Regime and Phases of Accumulation (all figures in %, represent average annual rates of growth)

Accumulation Regime		Full Period	A	B	C
I	Profit Rate	-2.00	2.29	-0.56	-23.08
	Profit Share	1.29	2.09	0.40	2.84
	Ouput Capital Ratio	-3.29	0.20	-0.96	-25.92
II	Profit Rate	0.21	1.54	0.17	-6.56
	Profit Share	-0.43	-0.41	-0.98	0.92
	Ouput Capital Ratio	0.64	1.95	1.14	-7.48
III	Profit Rate	0.43	3.03	-1.75	1.22
	Profit Share	0.26	0.65	-0.15	0.95
	Ouput Capital Ratio	0.17	2.38	-1.60	0.26

4.3 Decomposition Analysis: Short Run

I previously mentioned that a weakness of medium-run analysis is that it does not allow us to identify the underlying components of aggregate demand and technical change. However, we can solve this using a short-run analysis for what is needed to identify potential output through the co-integration method explained above.

To identify a cointegration relation between real output and capital stock, I follow an Engel-Granger method as discussed in Enders (2014). First, I need to ensure that both time series are integrated of order $I(1)$, i.e. stationary in first difference. To do so, an augmented dicky-fuller test with self-selected lags using an Akaike information criterion is estimated. Table 8 presents the τ values for test and its critical values at 1%, 5%, and 10% for the series of real output, capital stock, and their first differences. As can be appreciated, the null of unit root for real output cannot be rejected. However, once an augmented dicky-fuller test for the first difference is tested, the series turns to be stationary with 99% of confidence. So, the series of real output for the period 1900-2010 is $I(1)$. The same holds for the series of capital stock with an augmented dicky-fuller test for the first difference stationary at 90% of confidence.

Table 8: Augmented Dicky Fuller Test for Co-integration Method

	τ	1pct	5pct	10pct	Type
Y	-2.58	-3.99	-3.43	-3.13	Trend
ΔY	-7.9	-3.46	-2.88	-2.57	Drift
K	-1.65	-3.99	-3.43	-3.13	Trend
ΔK	-2.68	-3.46	-2.88	-2.57	Drift

Given that I have ensured that both series are $I(1)$, I can estimate the cointegrating vector for the long-run relation between real output and capital stock in real terms. So, I run an OLS regression to estimate equation (10), which gives us the cointegrating vector of real output and capital stock. Table 9 show the results of the OLS regression.

Finally, to test the cointegration relation, I run an augmented dicky-fuller test on the residuals. However, it is important to recall that in an Engel-granger method, we cannot trust in standard critical values rather than use those adjusted by sample size provided by in the supplementary table C of Enders (2014), considering sample size 100 and two

Table 9: Co-integration relation

	Dependent variable: Real Output
	Y
Trend	0.01***
	(0.003)
K	0.69***
	(0.10)
Constant	3.61**
	(1.60)
Observations	111
R^2	0.98
Adjusted R^2	0.98
Residual Std. Error	0.15 (df = 108)
F Statistic	2,772.44*** (df = 2; 108)
Note:	*p<0.1; **p<0.05; ***p<0.01

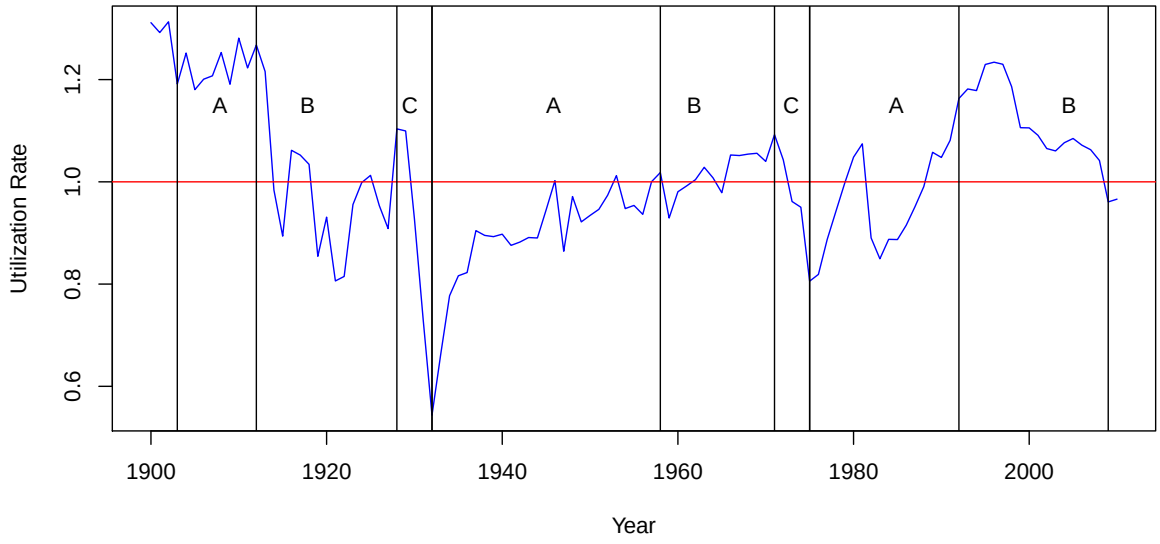
variables. As can be appreciated in Table 10, the tau value estimated by the augmented dicky-fuller test rejects the null of unit root with 95% confidence. So, the cointegrated vector is indeed a linear combination ensuring that the residual follows a stationary process with 95% confidence, i.e. is $I(0)$ (integrated of order zero).

Table 10: Augmented Dicky Fuller test for Engel Granger Method

	τ	1pct	5pct	10pct
Engel-Granger	-3.48	-4.01	-3.40	-3.09

As was previously argued, the residual of the cointegration relation between real output and capital stock in real terms is the utilization rate because it is the component of the relationship that is not explained by technical change. Figure 5 shows the time series for the utilization rate over the period 1900-2010. This variable is measured in percentages being 100% full capacity utilization. Hence, when the utilization rate is below 100% there is an underutilization of economic capacities. Likewise, when the utilization rate is above 100%, the economy is overutilizing economic capacities, i.e. is "overheated".

Figure 5: Utilization Rate. 1900-2010.



Source: Own elaboration based on CLIO-LAB, PUC

Interestingly, it is possible to appreciate breaks in the trend of the series in each phase of an accumulation regime. In the first, there is a sharp decline from the early to late expansion phase and a collapse of the utilization rate in the crisis period. In the second accumulation regime, there is a clear distinction when the utilization rate is below 100% in the early expansion and above 100% in the late expansion phase. Also, in the crisis period, a collapse of the utilization rate is appreciated. However, this is not so sharp as the one in the crisis period of the first accumulation regime. In the third accumulation regime, there is a high turbulence of utilization rate over the early expansion phase. On the contrary, the late expansion phase utilization rate reaches a peak above full capacity utilization and then declines secularly until the crisis period.

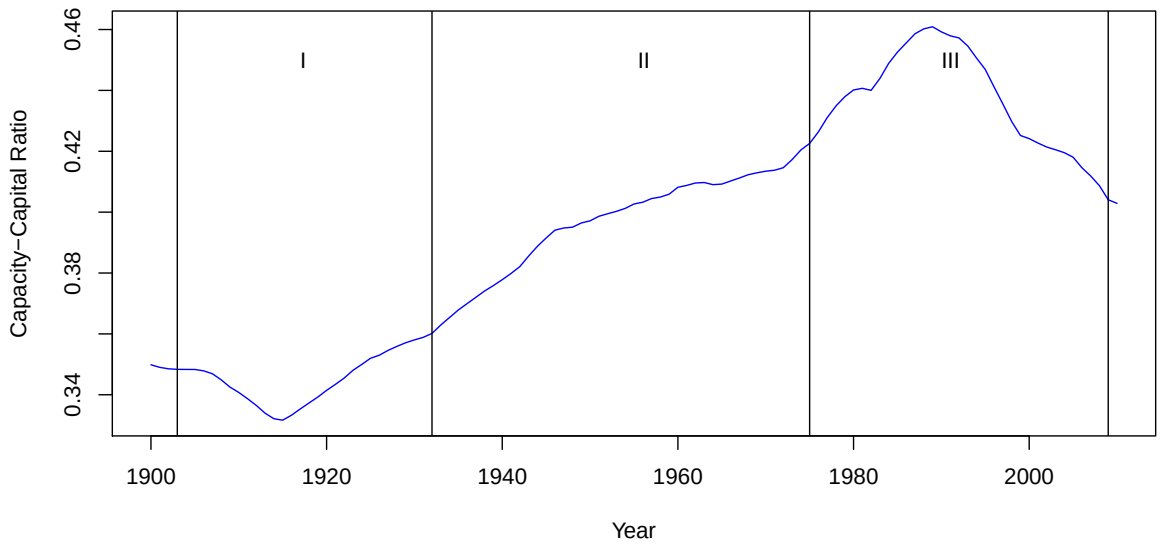
Estimating potential output, Y^*, also allows estimating the capacity-capital ratio σ. Figure 6 presents the estimation of this variable for the period 1900-2010. In figure 6 can be appreciated that the capacity-capital ratio has mostly an upward trend over the twentieth century except for the early expansion of the first accumulation regime and a downward trend in the late expansion of the third accumulation regime. A Marxist interpretation might consider this finding counterintuitive. Basu (2010) explains that a technical change

characterized by growing labor productivity, and while capital productivity stagnates or falls overtime is what Foley and Michl (1999) have named a Marx Biased Techincal Change (MBTC). The intuition behind this is that the choice of a new technique replaces labor by capital biasing technical change against labor but making capital less productive because the technical composition of capital grows faster than labor productivity.

Marx (1990) argued that during an industrialization process, the forces of competition incentive individual capitalists to introduce innovations raising the organic composition of capital, displacing workers by machinery in order to raise labor productivity per unit of output. Hence, individual capitalists would be able to capture super-profits from innovation, until other the new technique is socialized and other capitalists adopt the new technique making disappear the super-profits coming from innovation. However, this should not hold necessarily. Okishio (1961) argued that capitalist firms are primarily concerned about the adoption of new techniques to reduce their costs of production in order to raise their rate of profit. Assuming a constant real wage and technical change that holds constant the amount of labor used for increasing labor productivity, the adoption of a new technique would allow a decrease in the unit labor cost per unit of output, thus, raising the profit rate.

Basu (2019) argues that this controversy has been misleading when it is considered one case exclusive from another. Using a one-sector model, he demonstrates that both cases can hold depending on the conditions of the wage rate and the choice of technique. If the technical change is capital-using and labor-using and holds the holding the technical composition of capital constant, and the wage rate does not rise over a threshold, the rate of profit should increase with the Okishio theorem holding and the average rate of profit rising. However, if the wage rate rises over a threshold and the technical change are capital-using and labor-saving, MBTC will hold, and the average rate of profit will decrease.

Figure 6: Capacity-Capital Ratio. 1900-2010.

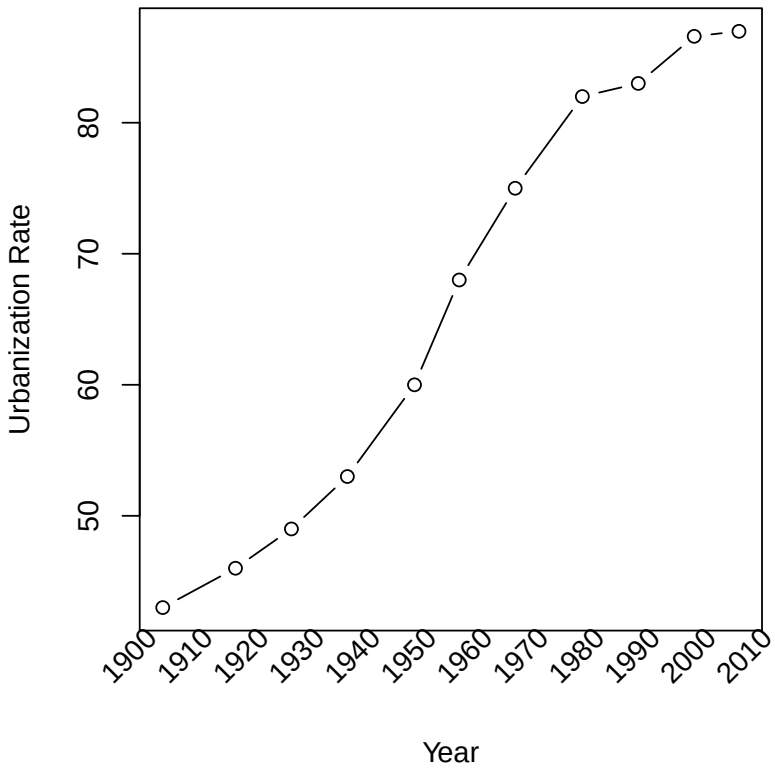


Source: Own elaboration based on CLIO-LAB, PUC

Once we consider the Okishio theorem and MBTC as non-necessarily exclusive tendencies rather than depending on the conditions of the wage rate and the choice of technique is straightforward to interpret why our finding for Chile is a rising capacity capital ratio for most of the twentieth century. The rise of capacities per unit of capital stock and its increasing effect on the rate of profit can be explained by an industrial take-off drawing cheap labor from the countryside *a-la* Lewis (1954). The process of urbanization where a surplus population is migrating from the countryside looking for jobs in cities in explain this tendency. As surplus labor remains available, the wage rate remains constant in urban centers. Moreover, the choice of technique in the early industrialization process as the one set in motion during the early expansion of the second accumulation regime is capital-using and labor-using. Hence, the capacity-capital ratio rises as Okishio predicted. During the early expansion of the second accumulation regime, the capacity-capital ratio is particularly fast, precisely when the speed of urbanization was higher in Chile. Later, this variable decelerates until the coup'd tat when it rises again. Shock therapy policies made a process of capitalist restructuring that destroyed productive capital policies and the destruction of productive capital until it reaches a peak. Once the process of urban-

ization is already completed and the discipline to the working class was applied in the debt crisis the tendency became a MBTC. Figure 7 shows the rate of urbanization for the twenieth century to make clear the relation with the dynamics of the capacity-capital ratio.

Figure 7: Urbanization Rate. 1900-2010.



Source: Own elaboration based on CLIO-LAB, PUC

Once characterized utilization rate and capacity-capital ratio, it is possible to realize the profitability analysis in the short run, i.e., decomposing its components considering aggregate demand. Therefore, the decomposition analysis can be repeated but now identifying short-run issues in the analysis. First, table 11 presents the profit rate decomposition for each accumulation regime. In the first one, the average rate of growth for the full period remains to be the same for the profit rate and the profit share, however, now it is possible to identify the same measures for the utilization rate and the capacity-capital ratio. The average growth of the profit rate in the first accumulation regime does not change from the previous analysis being negative in a magnitude of 2%. Nevertheless, it is possible

to identify that this is explained mostly by a collapse of aggregate demand because the utilization rate grows negatively on an average of 3.4%. Meanwhile, the positive growth of the profit share and the capacity-capital ratio are not able to compensate for the negative average growth of aggregate demand. The utilization rate and the capacity capital ratio explain the average increases in the profit rate in the second accumulation regime. Decreases in inequality (profit share) because a higher strength of labor also explain the increases in aggregate demand. A higher wage bill explains the growth of the utilization rate. On the other hand, the Okishio technical change explains the average growth of the capacity-capital ratio. A rising profit rate characterizes the third accumulation regime. An average increase in both profit share and utilization rate explains the rising path of profitability, the average negative growth of the capacity-capital ratio explained by MBTC is not enough to make the profit rate to fall.

Table 11: Profit Rate Decomposition. Short Run. (all figures represent average annual % rates of growth

	Full Period	I	II	III
Profit Rate	-0.17	-2.00	0.69	0.50
Profit Share	0.31	1.29	-0.37	0.27
Utilization Rate	-0.60	-3.40	0.69	0.38
Capacity-Capital Ratio	0.12	0.11	0.37	-0.14

As was done above, the profit rate decomposition also can be applied through phases of accumulation. It is relevant to repeat that each accumulation regime presents unique features of the reproduction of profitability in each phase; it can be drawn some conclusions from this decomposition. In table 12 can be appreciated that through phase A, the profit rate rises on average, what is explained by an average increase in the profit share. Meanwhile, in the medium run analysis, we observed a small contribution of the output-capital ratio in the short run analysis is possible to appreciate that the utilization rate has an average negative growth, which is compensated by an average positive growth of the capacity-capital ratio but only for a small magnitude. Phase B or late expansion, an average fall of the profit rate is explained by the positive growth of the profit share and the capacity-capital ratio. However, a significant average negative growth of the utilization rate makes the profit rate negative. Neither phases of early expansion or late expansion give an important characteristic of these phases of accumulation regimes.

However, phase C presents the expectable characteristic of a crisis phase. A decrease of the profit rate with increasing inequality and a collapse of aggregate demand as can be appreciated in Table 12.

Table 12: Profit Rate Decomposition by Phases of Accumulation. Short Run. (all figures represent average annual % rates of growth)

	Full Period	A	B	C
Profit Rate	-0.17	0.70	-0.12	-2.64
Profit Share	0.31	0.69	0.14	0.77
Utilization Rate	-0.60	-0.55	-0.69	-4.31
Capacity-Capital Ratio	0.12	0.56	0.43	0.90

Table 13 presents the short-run analysis for each phase of each accumulation regime. First thing to highlight is that in early expansion phases, the utilization rate always has a positive contribution to the profit rate; meanwhile the profit share is historically contingent, and the capacity-capital ratio depends if the technical change is following an Okishio dynamics or an MBTC. Given that the rural-urbal transition to capitalist modernity characterizes the twentieth century, the capacity-capital ratio is almost always positive in phases of early expansion, except for the first accumulation regime where MBTC takes place. Phases of late expansion are characterized by having an average negative growth in the profit rate except for the second accumulation regime, as previously mentioned. In the first and third accumulation regime, the utilization rate has in average negative contribution. The profit share has different results because, as have been mentioned is historically contingent on the state of the class struggle and distributive conflict. It also highlights that in the phase of late expansion is when the MBTC retakes place for the first time since the early expansion in the first accumulation regime, i.e., approximately after 80 years. Therefore, this shows that at the late expansion phase of the third accumulation regime Chile has become a wholly urbanized society with a dynamic of technical change biased against labor. The first and second accumulation regime crisis phases present the expectable dynamics where the profit rate collapses because of the collapse of aggregate demand and having regressive effects in the profit share. It is important to highlight that the magnitude of the crisis in the first accumulation regime is way higher than the second accumulation regime. The third accumulation regime presents other features in the crisis phase. Instead of a collapse of the profit rate, it presents a restoration explained by

increases in the average of the profit share and the utilization rate, despite that MBTC takes place with a negative contribution.

Table 13: Profit Rate Decomposition by Phases of Accumulation (all figures represent average annual rates of growth)

Accumulation Regime		Full Period	A	B	C
I	Profit Rate	-2.00	2.29	-0.56	-23.08
	Profit Share	1.29	2.09	0.40	2.84
	Utilization Rate	-3.40	0.58	-1.38	-26.24
	Capacity-Capital Ratio	0.11	-0.38	0.42	0.32
II	Profit Rate	0.21	1.54	0.17	-6.56
	Profit Share	-0.43	-0.41	-0.98	0.92
	Utilization Rate	0.28	1.52	0.98	-8.02
	Capacity-Capital Ratio	0.36	0.43	0.17	0.54
III	Profit Rate	0.43	3.03	-1.75	1.22
	Profit Share	0.26	0.65	-0.15	0.95
	Utilization Rate	0.35	1.96	-0.88	0.56
	Capacity-Capital Ratio	-0.18	0.42	-0.72	-0.29

5 Conclusions

This paper has argued that capitalist development unfolds through long-waves of capital accumulation. To understand the dynamics of accumulation regimes, a peak and trough analysis of the profit rate allows identifying their different phases: early expansion, late expansion, and crisis. Distribution and technical change are the key components that reproduce profitability, and understanding their dynamics is straightforward to identify the collapse of the export-oriented accumulation regime at the beginning of the twentieth century and the inwardly-oriented import substitution accumulation regime that took place at the middle of the century. Furthermore, this analysis allows arguing that the dynamics of distribution and technical change holds the stability of the neoliberal period despite the structural adjustment faced by this regime, such as the debt, Asian, and global financial crisis.

Several insights can be summarizes as conclusions of this paper. First, in the line of Marxist political economy argument that capital accumulation is driven by profitability, it has been shown that the profit rate is a crucial variable for economic growth. Sec-

ond, regression analysis indicates that the collapse of profitability explains crisis phases and that institutional characteristics of the ISI and neoliberal period produce higher economic growth than the export-oriented accumulation regime that took place in the early twentieth century. Third, higher economic growth takes place in phases of early expansion relative to phases of late expansion. This result holds despite the arguments of the "lost decade" made by neo-structuralist economists when they analyze the economic performance of the shock therapy policies imposed by the military dictatorship. Fourth, distributional patterns only present the recurrent pattern of regressiveness in crisis phases. On the contrary, over early and late expansion, the distributional conflict is historically contingent, i.e., is explained by the state of the class struggle. Fifth, the relevance of the process of urbanization is fundamental to understand the dynamics of technical change. While Chile was a surplus labor economy, technical change had favorable contributions to the profit rate. However, once the process of urbanization advanced, Marx-Biased Technical Change took place, having a negative contribution to profitability. Gains in capital productivity by improvements in telecommunications networks and transportations infrastructure also should be considered in this respect given its relevance in the process of extended urbanization (Brenner, 2013). More research in the Marxist political economy agenda is needed to link these issues with technical change.

The path-dependent and irreversible character of economic development demands a deep understanding of the historical anchors of the past to understand the dynamics and complexities of contemporary capitalism. Hence, it is relevant to insist on the fact that the patterns of reproduction of profitability in the neoliberal era provide stability for the accumulation regime. Particularly in these days, when massive revolts have shaken Chilean society, to understand that neoliberalism is not a set of policies is essential. Accumulation regimes are a complementary pattern of production, and consumption is a fundamental point of departure to discuss how to build an alternative society that works for the many and not for the phew.

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