WHY IS CUBA'S UNEMPLOYMENT RATE SO LOW? OR IS IT REALLY THAT LOW?

Ernesto Hernández-Catá[1]

For many years, Cuba's official unemployment rate has been remarkably low in comparison with other countries, including all those in Latin America (see Table 1). This has sometimes been attributed to cheating by authorities eager to show a good economic performance, particularly in the social area. But the low levels of unemployment reported by the Cuban statistical agency ONEI most probably do not result from statistical manipulation.[2] In fact, they are most probably a truthful reflection of what they are advertised to be: the number of jobless people actively looking for a job, in other words *open* unemployment.

But if there is no cheating, why is the official unemployment rate so low by international standards? And why is it so low even in periods where domestic economic conditions are extremely weak, like the early 1990s? The explanation suggested in this article is that, given the peculiar characteristics of the Cuban economy, the conventionally defined unemployment rate is a very bad indicator of labor market conditions. This is because: (i) it fails to take into account disguised unemployment, which at times has been extremely high; and (ii) it fails to include discouraged workers which in Cuba (and elsewhere) are normally

Table 1. Unemployment Rates in Selected Countries (In percent of the labor force)

Country	2005	2015
OECD	6.55	6.77
United States	5.07	5.28
Canada	6.75	6.94
France	8.49	10.36
Germany	11.17	4.63
Spain	9.15	22.06
United Kingdom	4.75	5.3
Japan	4.42	3.38
Latin America & Caribbean	9.0	6.5
Argentina	11.6	6.5
Bolivia[a]	8.1	2.5
Brazil	9.8	6.8
Chile	8.0	6.2
Cuba	1.9	2.4
Colombia	13.7	9.8
Costa Rica	6.9	9.7
Dominican Republic[a]	7.3	3.1
Ecuador	8.5	9.6
El Salvador	7.3	6.7
Honduras	6.9	8.8
Mexico	4.7	5.1
Nicaragua[a]	7.9	7.6
Panama	12.1	5.8
Paraguay	7.5	6.8

Source: Economic Commission for Latin America and the Caribbean, International Labor Office, and OECD

1. This article is a substantially revised version of a paper presented at the Conference of the American Economic Association in January 2019. I would like to thank Carmelo Mesa-Lago, Luis Locay and John Devereux for very useful comments on previous drafts.

2. Cuba's Oficina Nacional de Estadística e Información (ONEI) sometimes discontinues or suppresses publication of information under instruction from senior government officials, as was the case of earnings by the institutional sector, the structure of state subsidies, the value of oil exports, and updated numbers on the balance of payments. However, ONEI generally does not manipulate data, partly because of the integrity of its statisticians and partly because once you alter one variable it is very hard to maintain consistency among all the related variables. However, Mesa-Lago and Pérez-López (2009) suggested that "obfuscation" did occur in the case of GDP.

Table 1. Unemployment Rates in Selected Countries (In percent of the labor force) (Continued)

Country	2005	2015
Peru	9.6	8.5
Uruguay	12.2	7.8
Venezuela	12.3	7.1
Bahamas	10.2	12.0
Trinidad and Tobago	8.0	6.4
Jamaica	11.2	13.5

Source: Economic Commission for Latin America and the Caribbean, International Labor Office, and OECD

a. Data listed under 2015 is for 2014

SHORTCOMINGS OF OPEN UNEMPLOYMENT AS AN INDICATOR OF LABOR MARKET CONDITIONS

In line with internationally accepted definitions, open unemployment is the difference between the labor force and employment. In other words, it measures the number of people who are unemployed and are looking for a job. The problem is that, in the case of Cuba, the official rate suffers from a serious downward bias and is highly inaccurate (high variance) as an indicator of labor market conditions.

Open unemployment suffers from a downward bias for two reasons: (i) it fails to include disguised (or hidden) unemployment in the state sector, i.e., people who are *effectively* unemployed even though they are not looking for a job[3]; and (ii) it excludes discouraged workers, i.e., people who are by definition not part of the labor force because they are not looking for a job. Nevertheless, the evidence suggests that discouraged workers tend to move in and out of the labor force as cyclical conditions evolve.

Some of the issues related to unemployment in Cuba have been analyzed in previous studies. In particular, in his Ph.D. dissertation Carmelo Mesa-Lago (1968) provided evidence against the commonly held view in those days that full employment prevailed in centrally planned economies, including Cuba. In a 1972 article, Mesa-Lago made the key point that the Cuban government had reduced unemployment by replacing it by underemployment. The issue of hidden unemployment was also examined by the United Nation's Economic Commission for Latin America in its colossal book (1990), although the quantitative indicator they propose is seriously flawed (see the Annex to my 2015 article)—which may explain why CEPAL discontinued publication of this indicator. The present article differs from previous attempts to analyze disguised joblessness by deriving a quantitative indicator from a theoretical model—a model that can relate the evolution of hidden unemployment to its policy determinants, notably the level of state subsidies. It also deals with the somewhat different issue of discouraged workers.

A word should be said about the data problems confronted by any analyst of unemployment issues in Cuba. ONEI does publish annually a set of useful statistics including employment, the labor force, the population of working age, and the institutional structure of employment, in some cases disaggregated by gender and by province. However, it is silent on other important variables. For example, there is no information on unemployment compensation (if any), on the duration of unemployment, or on the number of discouraged workers. ONEI publishes data on the structure of employment by economic sector, but not on the structure of the labor force, making it impossible to estimate the sectoral structure of unemployment (and therefore of discouraged workers).

LOOKING FOR ALTERNATIVE INDICATORS

Figure 1 displays several alternative indicators of joblessness in Cuba, together with the officially-defined open unemployment rate u_0: the *effective unemployment rate* u_1, the *extended unemployment rate* u_2, and the *non-employment index* u_3. All three estimates show much higher levels than the official rate u_0 during the sample period 1989 to 2015. They also display considerably higher volatility. The way to move from one concept to the other is explained in Table 2.

Effective unemployment (U_1) is defined as open unemployment plus disguised unemployment in the

3. There is anecdotal evidence of moonlighting by some of the redundant employees.

Table 2. Cuba: Selected Unemployment Rates[a]

		1993	2001	2008	2011	2012	2013	2014	2015
u_0	Open unemployment	6.2	4.1	1.6	3.2	3.5	3.3	2.4	2.4
$u_{0'}$	Open unemployment	5.6	3.8	1.5	3.2	3.4	3.1	2.6	2.2
	plus: disguised unemployment	*45.8*	*4.1*	*19.1*	*20.3*	*16.6*	*15.6*	*14.9*	*12.3*
u_1	Effective unemployment	51.4	7.9	20.6	23.5	20.0	18.7	17.5	14.5
	plus: discouraged workers	*9.1*	*7.2*	*2.9*	*0.1*	*2.0*	*4.3*	*3.9*	*6.0*
u_2	Extended unemployment	60.5	15.1	23.5	23.6	22.0	23.0	21.4	20.5
	plus: permanently unemployed	*9.4*	*20.2*	*18.6*	*18.2*	*19.1*	*18.3*	*18.8*	*19.04*
u_3	Non-employment index	69.9	35.3	42.1	41.8	41.1	41.3	40.2	39.5

Source: ONEI and author's estimates

a. All variables are in percent of the potential labor force except u_0 which is in percent of the conventionally defined labor force; and u3 which is in percent of the population of working age.

state sector. (It is assumed to be zero in the private sector which, at least until recently, had not received state subsidies[4].) The effective unemployment rate ***(u_1)*** is the level U_1 divided by the potential labor force. The concept of potential labor force is used instead of the conventionally defined labor force because it is a broader measure of full employment[5]. Disguised unemployment is calculated as the difference between *total* and *active* employment in the state sector. Annex A provides a full explanation of how active employment (an unobservable concept) is estimated. In sum, the procedure is based on two profit maximizing conditions: one for those enterprises that receive government subsidies, and the other for those that do not. Two types of government subsidies are considered:

> (i) Subsidies for losses (*subsidios por pérdidas*) were introduced after the elimination of Soviet/Russian subsidies in the early 1990s to avoid a surge in open unemployment. They were removed gradually from 1994 to 2000 as the economy recovered, but have shown a tendency to rise since then.
>
> (ii) What *ONEI* mysteriously labels *"other subsidies"* which I believe are provided to offset the cost to domestic enterprises of oil imported from Venezuela.[6] These subsidies, introduced in 2001, increased rapidly through 2011. We don't know exactly what happened after that, because ONEI suddenly, and without explanation, stopped publishing the breakdown of state subsidies by category. But these subsidies most probably dropped after 2013 as the price of oil collapsed and Venezuela sharply reduced its supplies of petroleum to Cuba.[7]

The methodology described above to estimate active employment and hidden unemployment cannot be used for the period after 2011 for two reasons. First, as noted above, ONEI discontinued publication of key data required to implement this methodology. Second, in 2011 the government began to implement a radically new strategy to deal with hidden unemployment. In that year, it initiated a vast program aimed at cutting redundant workers from the state sector and stimulating private employment—perhaps the most important structural reform implemented by Raúl Castro's administration.

Table 3 shows the major changes in the structure of employment that occurred in connection with the administration's removal of redundant employees from the state sector. From 2010 (the year before the start of the plan) to 2016 (when the plan apparently

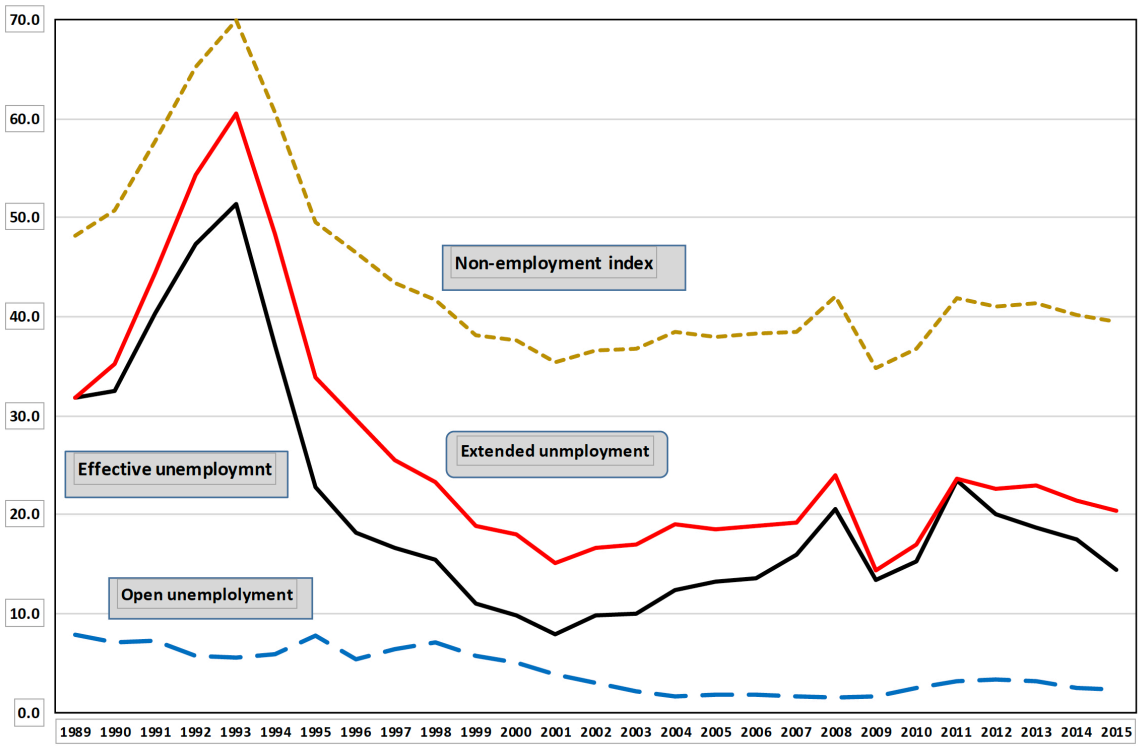
4. The relation between oil imports and "other" subsidies is examined in Hernández-Catá (2015a).

5. In this article the state sector includes the general government, state enterprises, and state-owned agricultural cooperatives such as the Agricultural Production Cooperatives (*Cooperativas de Producción Agropecuaria,* or *CPAs)*. Unlike the concept of state sector used by ONEI, it also includes the Basic Units of Cooperative Production (*Unidades Básicas de Producción Cooperativa* or *UBPCs*) which have suffered from considerable interference from government agencies and have received substantial subsidies in the past. Both definitions of the state sector exclude the considerably more independent Cooperatives of Credit and Services (*Cooperativas de Créditos y Servicios*, or *CCS*), which ONEI includes in the private sector.

6. The relationship between oil imports and "other" subsidies is examined in Hernández-Catá (2015a).

7. See Hernández-Catá (2019).

Figure 1. Cuba: Selected Unemployment Rates (In percent of the potential labor force)



Source: ONEI and author's estimates. For definitions see Table 2.

fizzled out), the number of state employees fell by an unprecedented 943,000, or 18% of the labor force at the beginning of the period. During the same period private employment rose by 550,000 (11% of the labor force) with most of the increase stemming from a rise in self-employment.

It should be noted that most of these changes had already occurred by 2014. During the period 2010–2014 (when the labor force was stable), state employment contracted by more than half a million, and private employment expanded by almost as much. By contrast, from 2014 to 2016 (when the labor force increased sharply) state employment continued to contract but private employment stopped growing. These numbers help us to answer a key question: where did the employees released from the state sector go? For the initial period 2010–2014 almost all the employees fired where absorbed by the private sector. For the entire period 2010–2016, however, nearly 60% of the employees fired joined the private sector, but 45% did not and moved out of the labor force.[8] They could not find a job in the private sector, or perhaps not one that was sufficiently attractive, and so became discouraged workers. In other words, they became effectively (albeit possibly temporarily) unemployed, although some of them probably joined the informal sector, on which there is no official information.[9]

Moreover, in sharp contrast with past practice, these cuts resulted directly from administrative action, and

8. The percentages do not add up to 100% because of small changes in open unemployment which actually declined during the period—illustrating the uselessness of this concept for analytical purposes.

9. Although some of the redundant employees released from the state sector beginning in 2011 received temporary transfers while they looked for a private sector job. See Mesa-Lago (2010).

Table 3. The Evolving Structure of Employment

	2010	2014	2016	Change 2011–14	Change 2011–16
	(Thousands)				
Labor force	5113	5106	4686	-7	-426
Employment	4985	4970	4591	-15	-393
State[a]	4395	3823	3452	-572	-943
Private	589	1147	1139	558	550
Self employment	147	483	541	336	393
Other	442	664	598	222	156
	(Percent of labor force)				
State	86.0	74.9	73.7	-11.1	-12.3
Private	11.8	23.1	24.8	11.3	13.0

Source: ONEI and author's calculations

a. State employment includes cooperatives

not indirectly from a reduction in subsidies. For these reasons, beginning in 2011, disguised unemployment was calculated in a different way, namely by assuming that the fall in redundant employees equaled the reduction in total state employment. This is somewhat arbitrary because changes in state employment can result from factors unrelated to government policy to cut redundant workers. But the effects of that policy were so large, that errors of this kind are likely to be quite small.

In 2010, President Raúl Castro recognized that a large number of inactive employees weighed down that the public sector. The government appraised hidden unemployment at approximately 35% of the labor force in 2011, compared with an estimated 20% obtained by using the subsidy-based model described above. For 2015 the official number was 26%, well above the 13% cited in this article. On the basis of these official pronouncements, Mesa-Lago (2000) projected that hidden unemployment would drop from 35% in 2011 to 26% in 2015. These are not mode-based estimates, however, but official targets (based on an unknown methodology) taken for granted and assumed to materialize in the future. They are not inferred from the data, and therefore cannot be subject to statistical testing. Nevertheless, both Mesa-Lago's numbers and those of the subsidy-based model indicate that hidden unemployment fell markedly after 2011, but that it remains substantial.

ESTIMATING THE NUMBER OF DISCOURAGED WORKERS

ONEI does not publish data on this variable and so it was estimated as the difference between the potential labor force *(F*)* and the conventionally defined labor force *(F)*, as explained more fully in Annex B. The estimated number of discouraged workers in Cuba has fluctuated significantly over the past three decades, rising during the post-Soviet crisis in the early 1990s, falling over the subsequent recovery through 2010, but increasing again from 2011 to 2015.

Discouraged workers declare that they are currently not looking for a job, but in practice they can be quickly induced to rejoin the labor force if real wages become sufficiently attractive. This is confirmed by the regression results presented in Table 4, which indicate a significant relation between the share of discouraged workers in the population of working age and the real wage in the public sector. Thus the adjusted unemployment rate ***(u_2),*** which includes discouraged workers in the numerator, would be a better indicator of labor market conditions.

Table 4. Cuba: Equations for the Number of Discouraged Workers

Explanatory variables				
Constant term c	Real wage in public sector ln(w/p)	Public sector employment E_s/N	Adjusted R^2	Standard error
13.1	-8.89	…	0.584	1.61
(8.9)	(6.1)			
28.8	-8.47	-0.27	0.728	1.30
(12.2)	(5.7)	(4.6)		

Source: The dependent variable in both equations is the estimated number of discouraged workers *(D)* as a share of the working age population *(N)*; *P* is the GDP deflator; E_s is employment in the public sector. The sample period is 1989–2015 (27 observations) Numbers in parenthesis are t-statistics.

To sum up, the plan to cut redundant employees from state agencies and enterprises and encourage them to join the private sector appears to have been fairly successful, even though it did not fully eliminate disguised unemployment. Moreover, some of the employees that were released failed to find a job in the private sector and decided to leave the labor force, at least temporarily. This is confirmed by the second regression of Table 4, which shows a significant negative relation between the share of discour-

aged workers in the labor force and the share of public sector employment. According to these results, a one percentage point cut in public sector employment leads to a ¼ percentage point increase in discouraged workers.[10]

DO UNEMPLOYMENT RATES REFLECT THE DEGREE OF LABOR MARKET SLACK?

Figure 1 and Table 2 illustrate how severely changes in labor market conditions have been obscured by focusing on open unemployment and ignoring changes in both hidden unemployment and discouraged workers. They also indicate that a significant fraction of Cuba's adult population continues to be unemployed, even though this fraction has diminished considerably since it peaked in the early 1990s.

Table 5. Regressions of Selected Unemployment Rates vs. Real GDP Growth

Dependent variable[a]		Real GDP growth	t ratio	Adjusted R^2
Open unemployment	u_0	-0.166	2.36	0.224
Effective unemployment	u_1	-1.131	7.51	0.698
Extended unemployment	u_2	-1.579	6.70	0.637
Non-employment index	u_3	-0.899	3.71	0.339

Source: Equations are estimated for the period 1990–2015 (26 observations).

a. Unemployment in percent of the potential labor force.

If an indicator of joblessness truly reflects the degree of labor utilization, it should be expected to be highly correlated with the growth of the economy. We performed regressions of the various unemployment rates discussed in this article against the growth of real GDP for the period 1990–2015 (Table 5). The broad unemployment rates u_1 and u_2 have much higher growth coefficients and much higher t ratios and adjusted multiple correlation coefficients. Even the broad non-employment index u_3 that includes persons unemployed for structural reasons, display higher goodness of fit statistics than the official rate u_0.

ECONOMIC POLICIES AND THE EVOLUTION OF UNEMPLOYMENT: AN INTERPRETATION.

The gap between actual and full employment levels of employment widened dramatically from 1990 to 1994, reflecting the termination of Soviet/Russian assistance and the deep economic contraction that resulted. Hidden unemployment surged as the authorities introduced huge subsidies to state enterprises. But the gap narrowed from 1994 to the mid-2000s, as the economy recovered and subsidies to enterprises were reduced. Thus, during that period the degree of labor market slack was absorbed at a much faster pace than would have been indicated by the official unemployment rate, as hidden unemployment plummeted and the number of discouraged workers dropped.

Growth accelerated from 2005 to 2008 against the background of large scale Venezuelan investments and oil subsidies. But in 2008–09 the Cuban economy was rocked by a severe financial crisis, as the effect of an overly loose fiscal policy was aggravated by a drop in the world price of nickel and three destructive tropical hurricanes, leading to an unusually large current account deficit and serious external payments difficulties. This experience suggested that the unsustainable expansion of aggregate demand in the mid-2000s had created a serious risk of overheating. Beginning in 2009, an appropriately tight fiscal policy accompanied by substantial wage restraint was adopted by the Raúl Castro administration, leading to an improvement in the external current account.

In 2015, the Cuban economy was hit by a deflationary shock as Venezuela cut oil deliveries by almost one half. The Cuban authorities reacted by shifting to highly expansionary fiscal, monetary, and wage policies. These policies, coupled with a boom in tourism, apparently succeeded in bringing about a resumption of growth in 2017, following a surprisingly small contraction in 2016. Labor market indicators during the period 2011–16 are difficult to interpret. As shown in Figure 1 and Table 2, the effective un-

10. It is also likely that some of the employees fired from the state sector moved to the underground economy, in which case our indicators would overstate joblessness.

employment rate did fall as the government's effort to shrink state payrolls was accompanied by a surge in private employment. But the decline in the extended unemployment rate was smaller because some of the employees released by the state did not find a job in the private sector and decided to move out of the labor force. Accordingly the participation rate (the ratio of the labor force to the population of working age) continued to decline. In the future, a higher contribution of labor to growth will be impossible without radical measures to improve labor participation and productivity.

IMPROVING LABOR PRODUCTIVITY AND PARTICIPATION

The most direct way to achieve these objectives is to increase the size of the private sector. This should involve primarily lifting the administrative restrictions that reserve most key sectors of the economy to the state. So far the areas where restrictions to private entry have been lowered involve mostly restaurants, hotels, small services, farming and, to some extent, construction. Even in these sectors high taxes and interference by government officials have held back production. Future actions should be much more ambitious, lifting restrictions on sports, culture, and manufacturing, and even in parts of health and education—for example by allowing private clinics and institutions of higher education.

Another way to improve labor productivity is by providing incentives for participation and work effort. Historical relationships suggest that the large salary increases granted to state employees in the past several years would persuade some discouraged workers to rejoin the state labor force. The increases will also help to increase work effort among state workers depressed by miserable levels of compensation. But there are negative effects on a budgetary situation that has seriously deteriorated in recent years. To some extent, these effects should be offset by continued efforts to reduce disguised unemployment. But this will not be enough, and so continued efforts to cut unnecessary expenditures will be required.

Labor market conditions could also be improved by allowing free negotiations between workers and employees. The recent agreement between the Cuban Baseball Federation and the U.S. Major League Baseball featured free contract negotiations between individual Cuban players and U.S. baseball teams. This was a landmark agreement that could have momentously enhanced the welfare of the players as well as the earnings of the Cuban baseball league, and could have encouraged similar agreements in other areas of the economy. Unfortunately, in a senseless action, President Trump vetoed the agreement.

In Cuba, rationing makes time a rare commodity. Waiting in line for food and other goods and services and waiting for the bus to show up, means that spouses often hesitate to take up a job and instead dedicate themselves to the unpleasant and highly time-consuming tasks imposed by the rationing system. The latest labor agreement in Germany's steel sector greatly improves the trade-off between work and leisure by allowing workers to choose between free time and compensation. In the Cuban context, such an arrangement would improve the trade-off between salary and time to stand in line, allowing spouses to take up a part-time job, thus improving the participation rate. Unfortunately, this solution may be too imaginative for ideologically minded leaders.

* * *

The conclusions offered in this article are based on estimates that are by no means precise. The results are sensitive to several assumption, particularly the application to government agencies of a model intended to capture the behavior of state enterprises. But the main conclusions are robust. In particular, the sharp turn towards expansionary macroeconomic policies following the Venezuelan oil shock means that, sooner or later, the economy will recover, and so will the demand for labor. Since Cuba's population is expected to decline over the medium-to-long-term, increased labor utilization is bound to reach a limit, and the continuation of expansionary demand policies will fail to stimulate output and threaten the sustainability of the external current account and the fixed exchange rate—which should be liberalized expeditiously, but preferably not in the context of a crisis. At that point, higher growth will not be possible without new structural reforms (in including the

ones proposed above) and a substantial increase in Cuba' exceptionally low rate of capital formation. The present regime will not end, but it will have to live with a miserable growth performance.

Annex A
MEASURING HIDDEN UNEMPLOYMENT

Since there is no published data on hidden unemployment, this variable was estimated on the basis of two types of subsidies provided by the Cuban government to state enterprises: (i) subsidies to avoid work dismissals and thus keep open unemployment low and avoid enterprise closures—an ancient communist preoccupation; and (ii) subsidies to insulate firms from the cost of petroleum products imported from Venezuela under the 2001 Accord. The methodology used can be summarized as follows.

The profit maximizing condition for a hypothetical state *enterprise that does not receive subsidies* is the familiar equality between the marginal product of labor and the after tax real wage rate, i.e.

$$\alpha\, y / E_s^* = (w + \tau) / p \qquad (1)$$

where E_s^* is the level of *active* state employment, α is the elasticity of output with respect to labor, y is output, p is the price level, w is the wage rate in the state sector, and τ is the payroll tax rate.[11]

Similarly, the profit maximizing condition for *an enterprise that receives a subsidy at a rate* σ on condition of avoiding layoffs is:

$$\alpha\, y / E_s = (w + \tau - \sigma) / p \qquad (2)$$

Dividing the first equation by the second yields:[12]

$$E_s^* = (w + \tau - \sigma) / (w + \tau)\, E_s \qquad (3)$$

Active state employment (E_s^*) can be calculated on the basis of this equation since all the right-hand-side variables are observable (except that the subsidy rate is no longer available for 2011 and subsequent years). The *level of hidden unemployment* is the difference between total and active state employment ($E_s – E_s^*$).[13] The *level of effective unemployment* is the sum of open and disguised unemployment ($U_1 = U_o + E_s – E_s^*$); and the *effective unemployment rate* $\boldsymbol{u_1}$ is the ratio U_1/F^*, where F^* is the potential labor force.

Annex B
ESTIMATING THE NUMBER OF DISCOURAGED WORKERS

ONEI does not provide information on the number of discouraged workers and therefore the data have to be estimated. The methodology used is as follows. The difference between the population of working age *(N)* and the labor force *(F)* has two components: a cyclical component consisting of discouraged workers *(D);* and an exogenous component *(X)* determined by demographic factors (notably age and gender). *X* may include stay-at-home spouses, early retirees, and the disabled. Using lower case letters to denote ratios to *N* yields:

$$n - f = x + d \qquad (1)$$

11. The derivation of this formula is explained fully in Hernández-Catá (2015a). The formula used in this paper is more complete, however, as it incorporates the effects of payroll taxes which include the social security tax and the "tax on the use of the labor force." In addition, this article incorporates the effect of subsidies on petroleum imports.

12. Luis Locay pointed out that this procedure assumes that state subsidies do not affect the level of output.

13. Non-subscripted variables apply to the entire economy, which comprises the state and the private sectors. The private sector includes the self-employed, small private farmers, the Cooperatives of Credit and Services, and a residual category that includes foreign enterprises, associations, and salaried private workers.

The unobservable components x and d can be estimated by assuming that the structural component X is a constant fraction $(1 - \lambda)$ of the population of working age. The discouraged workers ratio will then be:

$$d = \lambda\, n - f = f^* - f \qquad (2)$$

where f^* can be interpreted as the potential labor force ratio, a broad concept that includes discouraged workers. Table 4 shows that the rate of discouraged worker estimated according to this methodology is significantly correlated with the real wage rate.

Annex C
DEFINITIONS AND SOURCES OF KEY VARIABLES

Active employment *(E*)* is the sum of private employment and active employment in the state sector.

Active employment in the state sector (**ES***) is equal to total state employment minus hidden unemployment, which is estimated as explained in Annex A.

Discouraged workers (**D**) is the difference between the potential and the conventionally defined measures of the labor force.

Hidden unemployment (Û) is the difference between total state employment and active state employment. (See Annex A).

Potential labor force *(F*)* is the sum of the conventionally defined labor force and the number of discouraged workers. It is estimated as a constant λ multiplied by the population of working age, where λ is the historical peak level of the participation rate.

Payroll tax rate *(τ)* is the sum of social security contributions and taxes on the use of the labor force paid by enterprises, divided by total employment. Following Pérez (2000), enterprises are assumed to pay 5/17 of all social security contributions (a simplification of a more complex actual scheme) and 100% of the tax on the use of the labor force.

Real GDP *(y)* From ONEI, various issues.

Subsidy rate *(σ)* the sum of two types of state subsidies to enterprises divided by the number of employees in the state sector. The two subsidies are: (i) The subsidy for enterprise losses ("*transferencias a empresas por perdidas*"); and (ii) the subsidy to cover the cost of oil imports from Venezuela *("otros subsidios").* Both are from ONEI's fiscal table for the state sector. In 2012, ONEI discontinued publication of these two variables.

Total employment *(E)* includes state employment (both active and inactive) and private employment. From ONEI and author's estimates.

REFERENCES

Comisión Económica para América Latina y el Caribe (2000). *La economía Cubana: reformas estructurales y desempeño en los noventa*. México, D.F.: Fondo de Cultura Económica.

Hernández-Catá, Ernesto (2013) "Accounting for the Growth of GDP in Cuba. An Experimental Empirical Study", in Bryan Christensen and Basilgam Müslüm editors. *Economic Behavior, Game Theory and Technology in Emerging Markets."* London, IGI editors.

Hernández-Catá, Ernesto (2015a). "The Estimation of Disguised Unemployment in Cuba." *Cuba in Transition,* Vol. 25. Association for the Study of the Cuban Economy, Washington, D.C.

Hernández-Catá, Ernesto (2015b). "The thinning of Cuba's state labor force has slowed, but it has not stopped." Ascecuba.org//blog.

Hernández-Catá, Ernesto (2018). "Growth and Policy-induced Distortions in the Cuban Economy.

An Econometric Approach." *Cuba in Transition*, Vol. 28. Association for the Study of the Cuban Economy,

Hernández-Catá, Ernesto. (2019) "Cuba's Swaps of Petroleum for Doctors and the Impact of Cutbacks in Venezuelan Oil Deliveries." *Cuba in Transition*. Association for the Study of the Cuban Economy,

Kudlyak, Marianna (2017). "Measuring Labor Utilization: the Non-Employment Index." Federal Reserve Bank of St. Louis.

Mesa-Lago, Carmelo (1968). *Unemployment in Socialist Countries: USSR, East Europe, China and Cuba*. Ph.D. dissertation, Cornell University. Ithaca, NY.

Mesa-Lago, Carmelo (1972). *The Labor Force, Employment, Unemployment and Underemployment in Cuba, 1899–1970.* Beverly Hills Sage Publications, Inc.

Mesa-Lago, Carmelo (2010). "El desempleo en Cuba: de oculto a visible. ¿Podrá emplearse el millón de trabajadores que será despedido?" *Espacio Laical*. La Habana, April.

Mesa-Lago, Carmelo and Jorge Pérez López (2009). "Cuban GDP Statistics under the Special Period: Discontinuities, Obfuscation, and Puzzles." *Cuba in Transition*, Vol. 28. Association for the Study of the Cuban Economy, Washington, D.C.

Pérez, Lorenzo (2000). "Fiscal Reforms in Transition Economies: Implications for Cuba." *Cuba in Transition*, Vol. 24. Association for the Study of the Cuban Economy, Washington, D.C.