ESTIMATING DISGUISED UNEMPLOYMENT IN CUBA

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It has been recognized for decades that Cuba's predominant state sector is burdened by substantial levels of hidden unemployment, with far-reaching consequences for labor productivity, the fiscal position, and the interpretation of labor market statistics. Three aspects of this problem should be noted: (1) labor productivity and incentives to work are weaker than they would be if redundant workers were transferred to the private sector; (2) the subsidization of state enterprises to cover the losses they would otherwise suffer by retaining unproductive employees increases the government's budget deficit, which in post-Soviet Cuba must be financed either by increasing taxes or printing money; and (3) published data underestimate the true level of joblessness by a substantial and variable margin, thus seriously complicating judgements about resource utilization.

The Cuban authorities have recognized these problems and in recent years they have launched a program to reduce the number of redundant workers in the state sector. In the period 2011–2012, payrolls in the government and the state enterprises were cut by almost ½ million, and private jobs increased by more than 400 thousand. Economy-wide employment thus fell by about 100 thousand, but this was roughly offset by a decline in the labor force. These actions, without precedent in Cuba's communist era, are an important step in the direction of removing the distortions that have plagued the economy and stifled work effort and job search and growth. The remaining question is whether the recent reduction in disguised unemployment is sufficient, or whether a new round of labor transfers will be needed. Another important question is whether the workers that have recently been transferred to the non-state sector will be allowed to make a positive contribution to growth or whether, as has been the case in the past, they will be discouraged by excessive taxation and bureaucratic hassle.

The objective of this article is to construct a time series for the *active* labor force in Cuba's state sector and use it to derive proxies for disguised and effective unemployment.

STATISTICAL PROBLEMS

Official employment statistics in Cuba are known to suffer from serious shortcomings for two reasons.

1. On occasion they have been plagued by peculiar alterations made at the initiative of the government. Sometime in the early XXI century, the employment numbers were boosted by the incorporation of workers that had been fired (notably from the fledging sugar sector) and had been placed as students in re-training institutions. In the absence of specific information on how many students were involved and for how long they remained "employed" in those institutions, there is nothing that can be done about this.

2. A more serious issue is that the official unemployment data published in Cuba measure only *open* unemployment and thus ignores the existence of hidden, or disguised, unemployment in

the state sector. Therefore the published data underestimate, probably by a considerable margin, the *effective* unemployment rate, i.e. the fraction of the labor force consisting of people effectively at work. Yet, a meaningful measurement of excess supply of labor must be based on the *effective* unemployment, i.e., on the total number of unemployed—whether they are at home doing nothing but drinking Cuban coffee or in the office or the factory doing nothing but drinking Cuban coffee.

As far as I know there has been only one serious attempt to estimate disguised unemployment in Cuba.[2] The estimates constructed by the staff of the Economic Commission for Latin America and the Caribbean (CEPAL, 2010), indicate that hidden unemployment surged in the early 1990s, following the elimination of Soviet/Russian assistance, peaked in 1993 at 34% of the labor force, and declined gradually thereafter to 25% of the labor force in 1998.[3] The construction of this effective unemployment variable ("*equivalent" unemployment,* to use CEPAL's terminology) was a gallant attempt to deal with a complicated issue of major relevance for economic analysis and policy. However, as explained in detail in the Annex to this article, this variable has a few problems. First, it probably underestimates the *level* of hidden unemployment by assuming, for no obvious reason, that it was zero in 1989. Second, it was published only for the period 1989–1998 and has not been updated since then. And third, an attempt to extend these estimates yields negative rates of effective unemployment in the late 2000s.

DISGUISED UNEMPLOYMENT AND SUBSIDES FOR ENTERPRISE LOSSES

As an alternative, this paper estimates effective and hidden unemployment rates on the basis of the subsidies provided by the Cuban government to state enterprises as a *quid pro quo* for refraining from laying off workers, most notably in the immediate post-Soviet contraction. Data on these subsidies were published by the National Office of Statistics (ONE) as part of its presentation of the state budget under the heading of "subsidies for enterprise losses" (*subsidios por pérdidas*). Unfortunately publication was discontinued after 2012.

The objective of this paper is to estimate disguised unemployment in Cuba's entire state sector. Strictly speaking, the underlying model is suited to analyze the behavior of enterprises, not of government agencies or Ministries. At most, the model could be applied to the health and education sectors, where hospitals and schools could possibly be seen as enterprises. But the extension of the model to other government sectors like public administration, culture and security is admittedly a stretch. It is inevitable, however, because there is no breakdown of subsidies by sub-sector. Thus, the model implicitly assumes that the proportion of hidden unemployment in government entities is the same as in state enterprises.

Consider first a state enterprise that does not receive subsidies from the government and wishes to maximize its present value subject to a Cobb-Douglas production function relating output (*y*) to employment and the capital stock. Ignoring capital costs,

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2. Although the government may also have its own, unpublished, estimates.

3. Mesa-Lago and Pérez-López (2013) present "estimates" of hidden unemployment (see their Table 4.2, entitled *Alternative Estimates of Hidden Unemployment, 2010)*. But these are not independent estimates and simply re-statements of the authorities' announcements about their plans to dismiss workers from the state sector. Of course, the Cuban government may have its own estimates of hidden unemployment but, if so, they are unpublished.

this involves maximizing the difference between the firm's revenue (py) and its costs (wE^*), where w is the wage rate, p is the price of output, α is the elasticity of output with respect to the labor input, and E^* is the profit maximizing level of employment in the absence of subsidies. The solution to the firm's problem is the familiar equality between the marginal productivity of labor and the real wage rate.[4]

$$\alpha\, y/E^* = w/p \qquad\qquad (1)$$

In this model, the wage rate w is considered to be exogenous—a reasonable assumption in communist Cuba, where there is no collective bargaining and no possibility of wage negotiations, so that wages in the state sector are essentially determined by the government. (As noted below, this assumption might become invalid in the future if plans to impart some flexibility to the labor market materialize.)

Consider next a state enterprise that receives a government subsidy at a rate s per employee on condition of avoiding layoffs. The firm's goal is the same as before: to maximize the difference between revenue and labor cost subject to the constraint imposed by the production function, except that now its' unit labor cost is $(w-s)$, i.e., the difference between the wage rate and the subsidy rate. The profit maximization condition is now:

$$\alpha\, y/E = (w - s)/p \qquad\qquad (2)$$

where E is the optimal level of employment when the firm receives a subsidy. We now have two profit maximizing conditions: equation (1) applies in the absence subsidization; and equation (2) in the presence of subsidy rate s. Combining the two equations yields:

$$E^* = (w - s)/w\ E \qquad\qquad (3)$$

We interpret E^* as the firm's level of *active* employment, i.e., the level that would prevail in the absence of subsidization. It is not directly observable but it can be calculated on the basis of equation (3) using three observable variables: total (active plus inactive) employment E; the wage rate w; and the subsidy rate s. It should be noted that, in Cuba's situation, the level of output is not affected by the introduction of the employment subsidy.[5] This is because, after the disappearance of Soviet aid in 1989, Cuba had to finance state subsidies by increasing taxes (including the inflation tax). This resulted in a contraction of aggregate demand, thus offsetting any increase in real income resulting from the initial stimulus provided by the subsidies. In the end, a country cannot boost output by increasing subsidies, unless the subsidies are financed by friends abroad.

Other variables of interest can now be easily calculated. The *level of hidden unemployment $\hat{U}$* is the difference between actual and active employment, $E-E^*$; and the *hidden unemployment rate* is the ratio of hidden unemployment to the labor force, $\hat{u} = \hat{U}/F$. Using equations (2) and (3) and rearranging terms yields the reduced form:

$$\hat{U} = [s\,/\,w\,(w - s)]\,\alpha\,py \qquad \partial\hat{U}/\partial s => 0 \qquad (4)$$

Hence disguised unemployment is a function of the wage and subsidy rates, both controlled variables, and nominal income.

THE COMPLETE LABOR MARKET

So far it has been assumed for simplicity that the economy contains only one sector—the state sector, which includes the government and the public enterprises and accounted for roughly three quarters of both GDP and total employment 2012. The problem of hidden joblessness in Cuba is concentrated in the state sector. The non-state sector (which includes

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4. If the enterprise has oligopolistic powers, as many Cuban state enterprises probably do, the profit maximization condition would also include an additional a term involving the elasticity of the demand for output. However, this term would not affect the firm's decision to retain unproductive works.

5. The price level is also unaffected by the introduction of the subsidy because it is assumed to be controlled by the authorities. This is a realistic assumption for the early part of the sample period, but it is less realistic for the more recent past as some prices have been liberalized and others have been subject to occasional adjustments. Unfortunately separate data for controlled and uncontrolled price are unavailable. Finally, payroll taxes in principle should be included in equations (1) and (2). But they would have very little effect on the calculation of E^* since they would feature in both the numerator and the denominator of equation (3).

the cooperative and private sub-sectors) stagnated during the 2000s but increased sharply in 2011–12, even though its share of total employment and output remains small by international standards. With one minor exception, the non-state sector does not receive subsidies.[6] It can thus be reasonably assumed that hidden unemployment is inexistent in the non-state sector, and that non-state employment is as high as is tolerated by the government.[7]

On that basis, we can proceed to account for the various forms of occupation in Cuba using the following notation: subscripts *s* and *ns* denote the state and non-state sectors, respectively; and the absence of a subscript denotes the economy as a whole. By definition, the labor force (assumed to be exogenously determined by demographic factors) is the sum of total employment and open unemployment; effective unemployment is equal to disguised plus open unemployment; and total active employment is the sum of active state employment and non-state employment.

$$F = E^* + U = (E_s^* + E_{ns}) + (\hat{U}_s + U_0) \qquad (5)$$

Equation (5) defines the labor force (F) as he sum of total active employment (E^*) plus total unemployment (U). In turn, total active employment is the sum of state active employment (E_s^*) and non-state employment (E_{ns}). Total unemployment is the sum of hidden unemployment in state sector ($\hat{U}_s$) plus open unemployment (U_0). Using equations (4) and (5) and rearranging yields the reduced form:

$$\bar{U} = \hat{U} + U_o = F - [\alpha\, py\, /(w\text{-}s)] - E_{ns} \qquad (6)$$

Thus, given the labor force, effective unemployment can be lowered by reducing the subsidy rate, by raising the controlled levels wages, by increasing non-state employment, or through the growth of aggregate demand.

A GEOMETRIC INTERPRETATION

Diagram 1 provides a simple geometric interpretation of the model in which private employment, the labor force and the value of output are exogenous. If
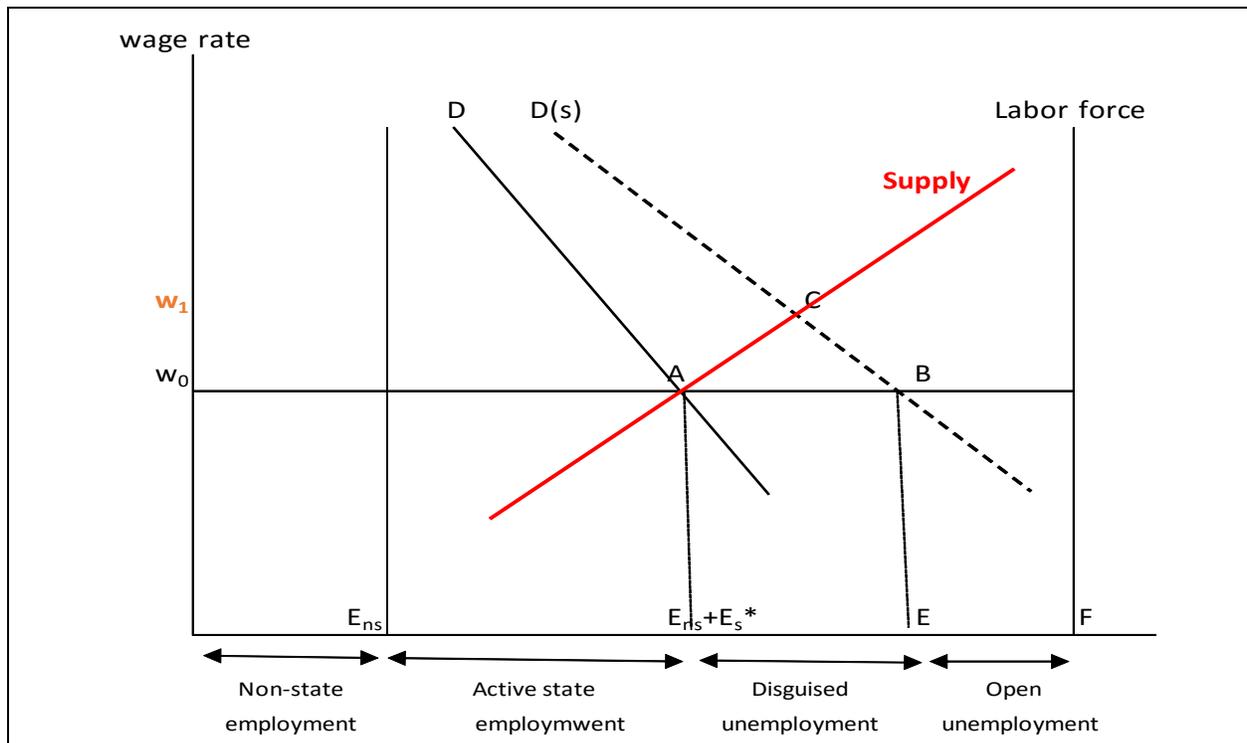
there is no subsidy, the demand for labor in the state sector is represented by the downward sloping line D. The profit-maximizing equilibrium occurs at point A, where the D schedule intersects the horizontal line representing the exogenous wage rate w_0. If the government introduces a subsidy on employment, the demand for labor schedule will shift to the northeast and there will be a new equilibrium at point B, where total state employment has increased but *active* state employment has remained at E_s^*. Open unemployment has been reduced at the cost of a rise in disguised state unemployment (which is now $E_s - E_s^*$). The subsidy works as an indirect form of unemployment compensation although, of course, it destroys incentives for job search and affects workers' morale by rewarding unproductive employees.

Diagram 1 also illustrates the impact of changes in exogenous variables.

- If the labor force is unchanged, a **decline in the subsidy rate** would move the equilibrium to a point somewhere between A and B, reducing state hidden unemployment but forcing the authorities to tolerate a higher level of open unemployment.

- An **increase in the authorized level of non-state employment** reduces open unemployment. The government could then decide: (i) to bring down the subsidy rate and lower disguised state unemployment; or (ii) to leave the subsidy rate unchanged and allow open unemployment to fall.

- An **increase in the demand for labor**, stemming for example from an exogenous expansion of aggregate demand, shifts the downward sloping demand for labor schedules to the right and leads to a new equilibrium points to the right of A and B, respectively, raising state employment. Here again the government faces a trade-off: it can reduce either open unemployment *or* disguised unemployment.

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6. The exception is the Basic Units of Cooperative Production (UBPCs), which started receiving transfers from the government after their creation in 1994. These transfers have now been discontinued.

7. Only the legal form of non-state employment—corresponding to the categories that have been explicitly authorized by the government—is considered here. Illegal private employment, which is thought to be large in Cuba, is not taken into account.

Diagram 1. The Labor Market with Disguised Unemployment

A BRIEF HISTORY OF DISGUISED UNEMPLOYMENT

The historical development of the Cuban labor force over the period 1989–2012 following equation (5) is pictured in Figure 1. Various concepts of unemployment are shown in Figure 2. Details on the relevant variables are provided in Table 1

The post-Soviet contraction. The estimated level of disguised unemployment surged in the early 1990s as the Cuban government attempted to replace Soviet transfers by money-financed domestic budgetary subsidies in a misguided attempt to prevent a massive rise in open unemployment. With prices subject to strict controls, a huge monetary overhang emerged, aggravating the collapse in economic activity that would have resulted anyway from the end of Soviet assistance. Subsidies surged from 1989 to 1993, and

so did disguised unemployment, which peaked at 54% of the labor force in 1993.[8] This number may appear to be very high, but it should be remembered that real GDP fell by almost 40% during that period (while *open* unemployment actually fell!), that prices were not allowed to adjust in response to the huge expansion of the money supply, and that subsidies for enterprise losses more than doubled.

The post-1994 recovery. Three major developments resulted from the stabilization/reform plan of 1993–1994: (i) subsidies for enterprise losses fell abruptly; (ii) prices, which had been rigidly controlled in the previous period, were allowed to rise somewhat, causing real wages to fall; and (iii) the government authorized a modest increase in non-state employment, mainly in agricultural cooperatives. Consequently, and as predicted by the model, disguised unemploy-

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8. This was equivalent to just over 60% of state employment. There are two ways to interpret this number: (i) about 60% of state employees in 1993 were goofing off; or (ii) all state employees were working about 40% of the normal time. It may be argued that defining the rate *s* in term of pesos per employee introduces an upward bias to the estimate of hidden unemployment because the subsidy may be provided to sustain output rather than employment. Recalculating *û* by defining the subsidy rate *ad valorem* (as percent of nominal GDP) yields a peak rate of 44% of the labor force in 2003, compared with 60% when the subsidy is calculated per employee. However, the difference between the two estimates narrows after that, and by 2010 they are approximately equal.

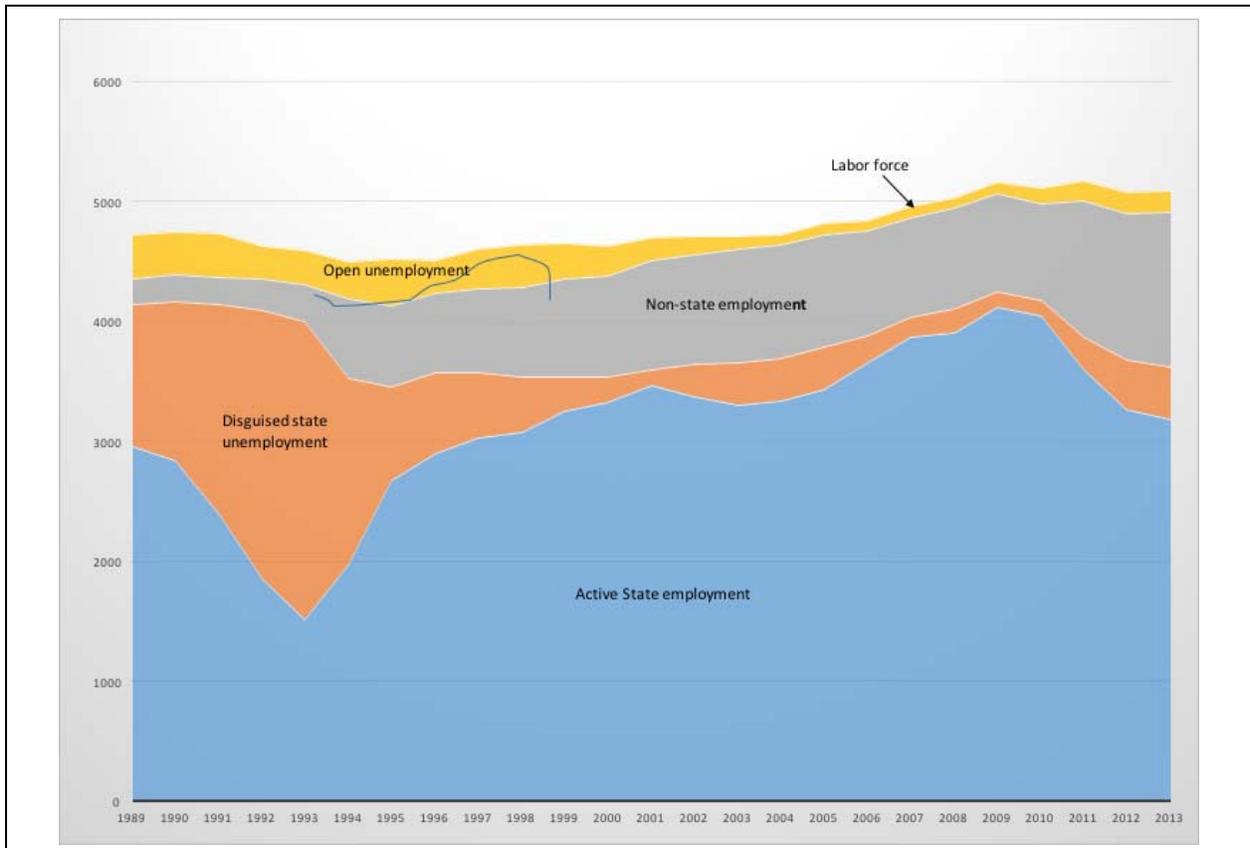Figure 1. Cuba: Structure of the Labor Force (in thousands of employees)

Figure 2. Cuba: Effective, Disguised and Open Unemployment Rates
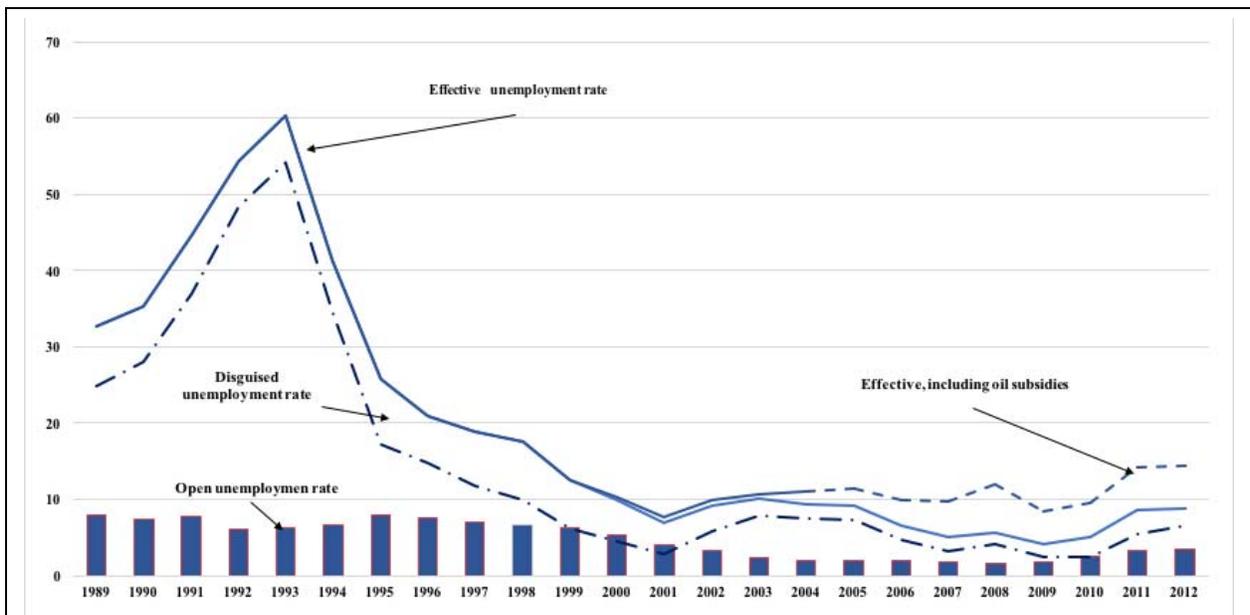(in percent of the labor force)

Table 1.   Cuba: Selected Concepts of Employment and Unemployment

	Government Subsidies		Published employment			Disguised unemployment	Unemployment rates (%)			with oil subsidy
	Million $	rate (%)	Total	State Official	State Active		without oil subsidy			
	S	s	E	E_s	E_s^*	$\hat{U} = E_s\text{-}E_s^*$	Open	Disguised	Effective	$\bar{u}_{oil}$
1989	2654	380	4356	4143	2966	1176	7.9	24.9	32.8	32.8
1990	2975	453	4394	4174	2848	1326	7.3	28.0	35.3	35.3
1991	3882	646	4374	4144	2396	1749	7.7	36.9	44.6	44.6
1992	4889	870	4352	4102	1864	2239	6.1	48.3	54.4	54.4
1993	5434	909	4313	4007	1519	2488	6.2	54.1	60.3	60.3
1994	3447	555	4195	3527	1974	1553	6.7	34.5	41.2	41.2
1995	1803	283	4131	3457	2682	774	7.9	17.1	25.0	25.8
1996	1624	246	4240	3575	2905	670	7.6	14.8	22.4	20.9
1997	1350	203	4279	3577	3031	546	7.0	11.9	18.9	19.0
1998	1139	168	4288	3541	3083	459	6.6	9.9	16.5	17.6
1999	770	112	4359	3543	3254	289	6.3	6.2	12.5	12.5
2000	596	85	4379	3541	3333	209	5.4	4.5	9.9	10.4
2001	393	56	4505	3602	3472	130	4.1	2.8	6.9	7.6
2002	862	124	4558	3648	3372	275	3.3	5.8	9.1	9.9
2003	1200	171	4607	3665	3299	366	2.3	7.8	10.1	10.6
2004	1197	168	4642	3694	3342	351	1.9	7.4	9.3	11.0
2005	1381	185	4723	3786	3437	349	1.9	7.2	9.1	11.6
2006	1039	134	4755	3889	3665	224	1.9	4.6	6.5	10.1
2007	784	99	4868	4036	3876	160	1.8	3.2	5.0	10.0
2008	1008	122	4948	4112	3910	202	1.6	4.0	5.6	12.5
2009	666	80	5072	4250	4120	129	1.7	2.5	4.2	8.6
2010	678	87	4985	4178	4052	126	2.5	2.5	5.0	9.9
2011	1520	210	5010	3873	3595	278	3.2	5.4	8.6	14.6
2012	1828	496	4902	3684	3353	331	3.5	6.6	10.1	14.8

Source: *ONE, CEPAL*, adisk dnd author's estimates.

Note: Employment numbers are in thousands; unemployment rates in percent of the labor force. The *subsidy rate* is the level of subsidies for enterprise losses divided by state employment. *Active state employment* is total state employment minus disguised state unemployment. The *total effective unemployment rate* is the sum of open and disguised unemployment rates.

ment fell sharply, reaching a trough of just under 3% of the labor force in 2001. Subsidies increased somewhat during the next several years before falling again in 2009–10. The disguised unemployment rate edged down to 2.5% in 2010, its lowest level since the end of Soviet assistance.

2010 to 2012: The new administration headed by Raúl Castro decreed a large cut in the state labor force and authorized an increase in the number of non-state sector employees; the private sector absorbed about 75% of the nearly 500 thousand decline in the state employment. The remainder was reflected in a rise in both open unemployment and discouraged workers. The government initially had announced a 1 million reduction of state employment by the end of 2011, but by the end of 2012 only about ½ million positions had been cut, and the process slowed sharply in 2013. Somewhat surpris-

ingly, subsidies for enterprise losses tripled from 2010 to 2012, and the result of this seemingly incoherent policy was that estimated disguised unemployment rose from 126 to 331 thousand workers (6.5% of the labor force). A possible explanation of this puzzle is that the government provided temporary subsidies to the newly privatized enterprises to smooth out the transition to privatization. This hypothesis cannot be verified, however, because subsidies for enterprise losses are not disaggregated by sector. In addition, the government is known to have offered temporary compensation to the employees that were fired from the state sector and did not immediately find a new job. However, the magnitude of such compensation is unknown, and it is not clear how it was classified in the official statistics. In addition, the rise in disguised unemployment probably reflected the slowdown of economic activity that re-

sulted from the unavoidable fiscal adjustment that followed the crisis of 2008.

In conclusion, the task of dealing with disguised unemployment is not complete. In fact the task may be even larger if, as explained in the following section, the effects of another subsidy—this one on oil imports from Venezuela—are taken into account.

OIL IMPORT SUBSIDIES AND HIDDEN UNEMPLOYMENT

The Cuban government extends subsidies to enterprises for reasons other than to limit open unemployment. In particular, since the beginning of the XXI century, the government has been extending subsidies to domestic enterprises for the use of oil imported from Venezuela under the highly favorable conditions specified in the 2011 Accord between the two countries.[9] The purpose of this subsidy is to cheapen the price of oil to domestic users without using scarce foreign exchange resources. Nevertheless, it may also have encouraged employment, albeit indirectly.

A thorough evaluation of the full impact of oil subsidies on the Cuban economy would require an explicit model of the domestic oil sector and is beyond the scope of this paper. However, it is possible to gauge the indirect impact of these transfers on disguised unemployment by assuming that the subsidy is paid *ad valorem* on the revenue of enterprises, i.e., $s_{oil} = S_{oil}/py$ where S_{oil} is the value of the subsidy and s_{oil} is the subsidy rate. Enterprise profits are then $(1 + s_{oil}) y - (w-s) E,$ and maximization subject to the production function implies:

$$E^* = (w-s) / [(w (1+s_{oil})] E \qquad (7)$$

To construct the revised estimate of active employment, we assume that the variable referred to in ONE's budget table as "other transfers to enterprises" consists primarily of subsidies for the use of petroleum and products. This cannot be proved, but

the indirect evidence is compelling. Figure 3 illustrates the high correlation between the level of the so-called "other subsidies" and the value of Cuba's petroleum imports from Venezuela.

The right-most column of Table 1 shows the estimated effect of introducing oil subsidies on the effective unemployment rate. Beginning in 2001 the gap between the estimates including and excluding the impact of these subsidies widens steadily, and by 2012 it reaches 4 percentage points. On this basis, the estimated number of redundant employees in the state sector was 741 thousand in 2012. Because of the limitations of the framework used to estimate the effect of oil subsidies, and because of the uncertainties concerning the basic data, these results should be interpreted with considerable caution. Nevertheless, they confirm that the task of eliminating disguised unemployment in the state sector remains substantial.
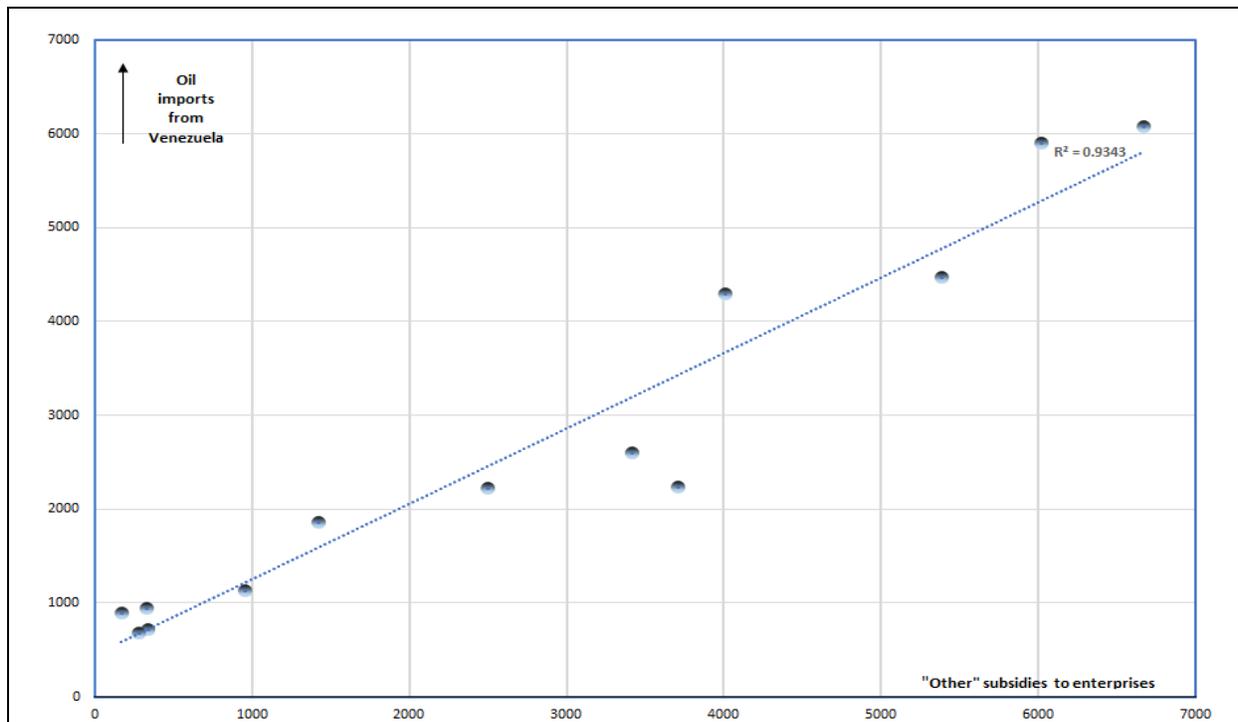
THE POSSIBLE IMPLICATIONS OF WAGE LIBERALIZATION

The assumption that the nominal wage rate is under the control of the Cuban authorities is part of the analysis presented so far in this paper, and it is probably fairly realistic for most of the period under review. This section examines an alternative assumption by introducing explicitly a supply of labor function relating the ratio of employment to the labor force and to the wage rate.

In Diagram 1, a positively sloped labor supply schedule replaces the horizontal line w_0 and intersects the post-subsidy labor demand schedule D(s) at a new equilibrium point C. If, wages were allowed to respond freely to changes in market conditions the introduction of a subsidy woul lead to a rise in the wage rate form w_0 to w_1. Relative to the controled wage scenario, this would involve higher active employment and lower disguised unemployment, but

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9. Details concerning the execution of the Accord are unknown, but there are two interpretations of how the system works. The first is that Cuban oil imports are bartered against services provided by Cuban doctors, teachers, soldiers and security personnel to Venezuela and a few other Latin American countries. The second is that oil imports are financed by long-term debt, but that Cuba presently does not service that debt because the Accord specifies a long grace period. In a sense the two mechanisms are equivalent: Venezuela subsidizes Cuban oil imports (virtually all of which are of Venezuelan origin) and the Cuban government passes on this subsidy to domestic users.

Figure 3.   Subsidies to Enterprise and Cuban Oil Imports (2000–2012) (In millions of dollars)

also higher open unemployument. It would increase wages and therefore stimulate work effort.

CONCLUSION

Low productiviy has been identified as one of the major reasons for Cuba's poor economic performance and its low per-capita income. Several factors account for this performance, including very low investment and the basic inefficiency of an economic system that is largely run by the state, stifles enterpreneuship and distorts resource allocation by controlling prices. But one important factor which is generally recognized, including by government officials, is the lack of incentives for work effort and job search which result from low wages but also from the existence of subsidized, hidden unemployment in the state sector.

The estimates presented in this article indicate that disguised and effective unmployment rates in Cuba were extremely high in the immediate post-Soviet period but came down steadily beginning in 1994 before stabilizing in the 2000s. Nevertheless, hidden unemployment remains high, particularly if oil subsidies are taken into ccount. Therefore an additional effort to lower effective joblessness will be required, involving an additional cut in government subsidies for enterprise losses and a further transfer of manpower from the state to the private sector. The latter will require a significant expansion in the list of activities that qualify for privatization, and a more favorable tax and regulatory framework for non-state activities. Continued efforts to introduce wage flexibility will also help to improve incentives, and increase labor productivity.

Annex
The "Productivity Gap" Approach to the
Estimation of Disguised and Effective Rates of Unemployment

In its monumental book on the Cuban economy, the Economic Commission for Latin America and the Caribbean (CEPAL, 2000) designed a method to calculate the level of disguised unemployment in Cuba. My interpretation of the procedure used by *CEPAL* is as follows.

Let the labor/output ratio be denoted by λ and assume that the ratio of active employment to output (E^*/y) is a constant equal to λ_o, the value of λ in 1989. The level of disguised unemployment can then be calculated as the difference between total employment and active employment:

$$\hat{U} = E-E^* = (\lambda - \lambda_o)\,y \qquad (8)$$

where ($\lambda - \lambda_o$) is inversely related to what *CEPAL* calls the "productivity gap" (*brecha de productividad*).

This approach offers a simple way to calculate disguised unemployment since all the variables on the right-hand side of the equation are observable. But it has a few problems.

- First, CEPAL's estimates of disguised unemployment have not been updated beyond 1998. We can use the equation above to calculate this version of disguised unemployment beyond 1998, but it would not be fair to attribute the result to *CEPAL*. We will call this the "productivity gap" approach.

- Second, CEPAL assumes that disguised unemployment was zero in 1989. Yet, the level of state subsidies for "enterprise losses" was already quite large in that year.

- And third, actual labor productivity—and therefore the so-called "productivity gap"—can change over time for a variety of reasons (sudden destruction of capital as occurred after the end of Soviet assistance,[10] hurricanes, or movements of labor across economic categories with different productivity levels). These changes may or may not have anything to do with changes in hidden unemployment.

Figure A compares the estimated rates of hidden unemployment under the "productivity gap" approach and the approach developed in this paper. Both estimates increase sharply from 1989 to 1993 and decline therafter, alhough the decline is much quiker in the case of the "subsidy rate" approach. At the turn of the century, however, the "subsidy rate" estimate levels off and remains positive through the rest of the period, while the "productivity gap" estimate continues to fall and turns negative in 2006

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10. See Hernández-Catá (2013a) for an explanation of the role played by the interruption of Soviet/Russian deliveries of capital goods in the 1990–1994 crisis.

Figure A.   Cuba: Alternative Estimates of Disguised Unemployment
         (In percent of the labor force)