# A model of Prisoner of War profitability, with application

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Moore finds that Italian Prisoner of War (POW) employment in Australia was profitable. He describes the POWs' contribution to the Australian war economy as "significant"[1] and claims that POW employment in Australia yielded a net profit.[2] However, he only conducts a qualitative analysis of the Australian data. This paper proposes a quantitative model of POW profitability. It discusses how this model can be used to determine whether POW labour during the Second World War was profitable to the holding country. Canada is used here as a case study, with the aim to broaden the analysis to include other Commonwealth countries in the future. The quantitative analysis of this paper provides some early numerical estimates of POW profitability. Note that this paper is preliminary in nature and is designed as the departure point for class discussion.

## 1. Theoretical model

The financial profit derived from working POWs could be negated or exceeded by the overall maintenance costs of all POWs. Hence, profit equals wage receipts of the proportion of the POW population working, less the costs of maintaining the entire POW population. Equation (1) expresses this relationship:

$$\prod = [ L \cdot \alpha (x)] - (c \cdot x ) \quad (1)$$

Where $\prod$ is the net profit from POW employment and maintenance for the government per day; $L$ is the net wage receipts per POW per day (the value is defined in monetary terms as the wage rate per POW per day received by the government from employers less costs incurred by the government in providing this labour); $\alpha$ is proportion of the POW population which is working at time $t$; $c$ is capitation rate (the cost incurred by the holding country per POW per day, where costs include pay, accommodation, food, transport, guarding and camp maintenance); and finally $x$ is overall POW population at time $t$.

At breakeven point, $\prod = 0$, so the equation becomes:

$$[ L \cdot \alpha (x)] = (c \cdot x ) \leftrightarrow L \cdot \alpha = c \quad (2)$$

Therefore, a profit is obtained if: $L \cdot \alpha > c$ (3)

and a loss is obtained if: $L \cdot \alpha < c$ (4)

These equations can now shed light on the question of profitability as (3) and (4) can be used as profit or loss indicators.

[1] Moore, *Empire*, p.189
[2] Ibid, p.197

## 2. An application of the model: Canada during the Second World War

New evidence from British Treasury sources casts light on the issue of profitability. The Treasury was concerned with POW costs in Canada because Britain had agreed to pay for POW maintenance in Canada.[3] She paid for all POW costs except for guarding, hospital staff and POW working pay in return for Canada's housing of their POWs.[4] In 1945, Petch, a Treasury official, calculated a breakeven point. Given estimated annual costs of £2.2 million and profits accumulating at an annual rate of £2.4 million and considering that transport costs were not yet accounted for, he concluded that "there is not very much between the two, if my figures are right."[5] POW labour was however profitable in a different manner. Petch estimated POW labour costs at £700,000, 30% of the annual cost figure, as approximately 30% of all POWs were working at that time. This cost figure is oversimplified and exaggerated. Maintenance costs for working POWs normally were lower than for those not working since employers normally bore boarding and lodging costs.[6] Still, using Petch's estimates as an upper bound for costs, POW employment alone would have yielded a minimum annual gross profit of £1.7 million.

Further evidence sustains POW labour profitability. Keynes reported in November 1945 that the Canadian government fund for net POW profit was accumulating at a rate of $200,000 per month.[7] Parliamentary sources give a figure of $1,853,296 for projected overall POW costs for 1945-46 in November 1945.[8] Assuming constant revenues, POW labour would have yielded an annual net profit of $546,704. While this result amounts to a breakeven, it shows that approximately 30% of the POWs were able to cover the maintenance costs of the entire POW population. As these figures represent cost and profit projections and not actual returns, they have to be interpreted with caution. Also, the British Treasury noted in 1946 that based on informal evidence POW employment would be a "net loss".[9] The Canadian government, however, claimed that POW labour was profitable. Labour Minister Mitchell stated in parliament in August 1946: "We have been able to return about $2,125,000 to the Treasury arising out of the employment of POWs."[10]

[3] See also section 5 b) for details on this arrangement.
[4] CHC, 1945, volume II, p.1768
[5] NA, T 225/26, handwritten note Petch to Williams, 3rd December 1945
[6] CHC, 1946, volume III, p.1572, 16th May 1946
[7] NA, T 225/26, memorandum from Keynes to Eady, Washington, 23rd November 1945, point 7
[8] CHC, 1945, volume II, p.1768
[9] Mr Grant (War Office ) was told this in Canada by an unknown official. See NA, T 225/26, letter Grant to Townsend, 17th April 1946
[10] Canadian House of Commons, session 1946, volume V, p.5725, 31st August 1946

This figure represents annual rather than aggregate revenue as other evidence reveals. The Canadian Labour Department reported a revenue of $2 million for the fiscal year 1945-1946 in April 1946.[11] Again, however, the statement does not prove a profit as Mitchell only mentions gross and not net profit figures. Therefore, employing the profitability model and the evidence from above, I will calculate a first estimate on POW labour profitability in Canada.

In general, the benefit from POW labour in Canada can be described as:

$$benefit = ( market\ wage - POW\ wage ) \cdot productivity\ adjustment$$

Using data on market wages, I derived a POW productivity proxy of 48 -57% for farming in Ontario in 1945.[12] As other evidence for Canada is not available, we turn to other countries to obtain an aggregate productivity range. Overall, POW productivity was very volatile (see table1). According to employers, German POWs in the US were 30-50% as productive as civilian labour owing to humid climate and lack of supervision.[13] In Australia, low output and extreme climatic conditions resulted in a productivity share of Italian POWs of 30%. [14] POW output in Britain was calculated as 75% of civilian male workers' output.[15] Employment types in Canada were roughly similar to those in the US. Therefore, 30% as a minimum, 48% as a regional proxy for 1945 and 75% as a maximum value are used for the following calculations. Next, we have to ascertain POWs maintenance and employment numbers . The average for 1945 is used as employment and cost figures are most detailed for that year. On average during 1945, 12,375 POWs were employed[16] and 33,720 POWs maintained (see table 3).[17] Hence, employment share was 36.6%.

[11] Canada Labour Gazette XLVI, 1946, p. 574
[12] Market wage was $3.62 per day or 86.88 per month. The farmer paid $1.75 per day or $50 per month, so he paid 48% or 57% of the market wage for POW labour.
[13] J.E. Fickle and Donald W. Ellis, *POWs in the Piney Woods : German POWs in the Southern lumber industry*, p.712
[14] NA T225/26, Debuty High Commissioner to Australian government to Lalor at WO, 20th Decemeber 1946
[15] NA, MAF 47/138 , August 1945 notes on charges for Italian and German Prisoners of War
[16] As 15,200 from October 1945 is the only available figure for quarter IV 1945, it is used as a quarter average. Using the remaining quarter averages from 1945, an annual average of 12,375 POWs working is attained.
[17] Wolff's quarterly estimates for 1945 were added and divided by 4 for this figure.

**Table 1. Productivity of POWs as share of civilian productivity (%) across the Commonwealth and in the US**

| Country and POW type | POW productivity as share of civilian productivity (%) |
|---|---|
| US ( German POWs ) [a] | 30 -50% |
| Britain ( Italian and German POWs ) [b] | 75% |
| Australia ( Italian POWs ) [c] | 30% |
| Canada ( German POWs,Ontario 1946 )[d] | 48 - 57% |

*Sources:*

[a] J.E. Fickle and D.W. Ellis, *POWs in the Piney Woods : German POWs in the Southern lumber industry*, p.712

[b] *NA, MAF 47/138 , August 1945 notes on charges for Italian and German Prisoners of War*

[c] *NA T225/26, Debuty High Commissioner to Australian government to Lalor at WO, 20th December 1946*

[d] *CHC, 1946, volume II, p.1572, 16th May 1946*

Britain had agreed to pay for POW maintenance in Canada. She reimbursed Canada all expenses except for guards and transport for POWs and internees captured by the British and held in Canada. Canada paid for POWs and internees captured on Canadian soil[18] and retained all the profits of POW employment.[19] In order to ascertain a full profit and loss account, we therefore require Canadian costs and profits and UK costs. All three items are only available for 1945. British Treasury documents depict British costs, Canadian Hansards contain Canadian costs and Canadian market wages are shown in table 2 below. British Treasury files present two quarterly figures for 1945. A daily average was calculated from these figures[20] of £6,670 or $29,548 per day.[21] Canadian Hansards give $1,853,296 as an estimated annual figure for "internment operations" in 1945.[22] Hence, overall costs per day in 1945 in Canadian dollars are given as:

[18] CHC, 1945, volume II, p.1768

[19] After a retrospective waiving of war claims, Canada did not charge Britain with costs of POW employment but retained labour proceeds at the same time. NA, T 225/26, Letter to Petch from WO, January 1946

[20] NA, T 225/26, Letter to Petch from WO, January 1946, annexe "statement of payments made to Canada in respect of POWs held on behalf of UK government until 30th September 1945" shows British costs 1941-45. Quarter III/45 and quarter IV/1945 were added up and divided by two.

[21] Exchange rates were fixed in Canada for the duration of the war and until revaluation on 5th July 1946. Rates were 1 £= $4.43 and 1 $= £0.2237. See 'Canada under fixed Exchange Rates and Exchange Controls 1939-50', Bank of Canada Online archive, p.54.

[22] CHC, 1945, II, p.1768

British costs $29,815.5362

Canadian costs $ 5,077.5233

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Overall costs $34,893.06 per day for all POWs in 1945

As 33,720 German POWs were maintained on average in 1945 ( see table 3), cost per POW per day was $34,893.06/33,720 = $1.0348

The calculation of benefits involves the equation:

*benefit = ( market wage – POW wage ) · productivity adjustment*

We have three different values for productivity, namely 0.75 as a maximum ($L_1$), 0.48 as a regional proxy ($L_2$) and 0.3 as a minimum value ($L_3$). As the reference market wage for $L_1$ and $L_3$, the farm help wage for 1945 without board in the POW provinces is taken because the majority of POWs were employed in this sector and because POW were only found in these provinces.[23] The respective average wage of all provinces with POW employment is $4.54.[24]

**Table 2. Male farm help wages per day without board in Canadian $in selected Canadian provinces**

| | 1943 | 1944 | 1945 | 1946 |
|---|---|---|---|---|
| **Alberta** | **4.19** | **4.72** | **4.94** | **5.17** |
| **Ontario** | **5.73** | **4.09** | **4.36** | **4.55** |
| **Manitoba** | **4.20** | **5.53** | **4.98** | **5.66** |
| **Quebec** | **4.70** | **3.50** | **4.12** | **4.36** |
| **New Brunswick** | **3.52** | **3.73** | **4.32** | **4.44** |
| **Canada average** | **4.74** | **4.39** | **4.5** | **4.95** |
| **POW provinces average** | **4.47** | **4.32** | **4.54** | **4.84** |

*Source:* Canadian Labour Gazette 1945, p. 937

[23] In 1944, 9% of all POWs employed were merchant seamen (CWM, "5,500 Nazis at work", *The Financial Post*, 26th May 1944). Thus, 9% of all working POWs employed in farm work with board. The majority of POWs was thus employed without board in agriculture.(See also p.39 above)

[24] This figure is the arithmetic average of all provinces for 1945 in table 2.

**Table 3. German POW employment and maintenance in Canada 1941-1946**

| Year | Quarter | Overall POW figure | Total POW employment | POW employment share (% ) |
|---|---|---|---|---|
| 1941 | Quarter I | 2740 | 0 | 0 |
| | II | 2950 | 0 | 0 |
| | III | 2940 | 0 | 0 |
| | IV | 2940 | 0 | 0 |
| 1942 | I | 2940 | 0 | 0 |
| | II | 4640 | 0 | 0 |
| | III | 7630 | 0 | 0 |
| | IV | 12380 | 0 | 0 |
| 1943 | I | 16540 | 0 | 0 |
| | II | 17110 | 0 | 0 |
| | August 1943 | 17900 | 500 [a] | 2.8 |
| | 29/9/1943 | 18350 | 1000 [b] | 5.5 |
| 1944 | 09/3/1944 | 19540 | 4117 [c] | 21.1 |
| | 31/3/1943 | 19540 | 5428 [d] | 27.8 |
| | 26/5/1944 | 21400 | 5500 [e] | 25.7 |
| | Quarter IV | 31930 | 8500 [f] | 26.6 |
| 1945 | I | 33700 | 10000 [f] | 29.7 |
| | II | 33730 | 11500 [f] | 34.1 |
| | III | 33750 | 12800 [f] | 38.0 |
| | 01/9/1945 | 33800 | 13660 [g] | 40.4 |
| | 21/11/1945 | 33700 | 15200 [h] | 45.1 |
| 1946 | 10/6/1946 | 8600 | 3387 [i] | 39.4 |

*Note:* Roman numerals indicate quarterly figures. Overall quarter figures are taken from Wolff, Kriegsgefangenen, p.98 and monthly figures from op. cit., pp.20-21.

*Sources of employment figures:*

a Canadian Labour Gazette 1943, p.1074; b Globe and Mail, 29th September 1943 , figures for woodcutting only c Canadian House of Commons, session 1944, volume III, p.2436; d Auger, Prisoners, p.108; e Financial Post, 26th May 1944; f NA, T 225/26," POWs in Canada", II, no.3; g HoC, 1945, p.595; h Canadian House of Commons, session 1945 , volume II, p.2374; i Canadian House of Commons ,session 1946, volume III, p.2323, figures for sugar beet farming only

The benefit per working POW per day in Canadian $ therefore was:

75% productivity : $L_1$ = 4.54-0.5 = 4.04; 4.04 · 0.75 = $3.29

48% productivity : $L_2$ = 2.08-0.5 = $1.58 [25]

30% productivity : $L_3$ = 4.54-0.5 = 4.04; 4.04 · 0.3 = $1.21

These values can now be inserted into profit function (1) from section 1:

$\prod = [L \cdot \alpha(x)] - (c \cdot x)$

$L_1 = 3.29$

$L_2 = 1.58$

$L_3 = 1.21$

$\alpha = 12{,}375 / 33{,}720 = 0.366$

$c = 1.0348$

$x = 33{,}720$

We yield using

$L_1$ a net profit of $5,820.7 per day = $2.124 million p.a.

$L_2$ a net loss of $15,340 per day = $5.6 million p. a.

$L_3$ a net loss of $ 19,920 per day = $7.27 million p.a.

The gross benefit for the working POW population is:

$L_1$ : (3.29 · 12,375) – (1.0348 · 12,375) = $27.908.25 per day = $8.372 million p.a.

$L_2$ : (1.58 · 12,375) – (1.0348 · 12,375) = $6,747 per day = $2.024 million p.a.

$L_3$ : (1.21 · 12,375) – (1.0348 · 12.375) = $2,168.25 per day = $650,473 p.a.

In the best case scenario, revenues of $8.3 million would have resulted in a net POW maintenance and employment profitability of 25% or $2.12 million. In the worst case scenario, a loss of $7.27 million would have been incurred. POW employment still would have mitigated losses by 9% or $650,473. Finally, we have to consider the cost arrangements between Canada and Britain. Canada paid employment costs and retained the benefits. Hence, the gross benefit figures above delineate Canadian receipts. It is unclear whether Britain paid all other remaining costs. If, in the worst case for Canada, we assume that internment costs given in Hansards have to be included as well, Canada made a profit of $6.8 million using $L_1$ and a loss of $800,000 using $L_3$. Britain paid £2.42 million or £72 per POW p.a.[26] Table 4 shows that POW maintenance in Britain cost £84 p.a. and £93 in Australia. Both countries

[25] This figure does not need to be adjusted for productivity because the farmers already paid less than the market wage.
[26] Britain paid £6,670 overall per day in 1945. Hence, (6,670*365)/33,720 yields annual British cost per POW of £72.19. Calculations are based on figures from NA, T 225/26, Letter to Petch from WO, January 1946.

disposed of a relatively efficient POW maintenance system. The fact that POW maintenance in Canada appears cheaper than in Britain and Australia emphasizes the efficiency of the Canadian system. The extraordinarily low Canadian c value could explain the scope for POW profitability in Canada despite unfavourable other variables. Overall, cost arrangements transformed the POW maintenance and employment system into a cost burden for Britain and a vast potential profit source for Canada.

**Table 4. Average annual POW maintenance costs in Britain, Australia and South Africa**

| | Australia | Britain | South Africa |
|---|---|---|---|
| Gross cost per POW p.a. | £122 | £89 | £40 |
| Net cost / POW p.a. | £93 | £84 | N/A |
| Credits from work per POW p.a. | £29 | £5 | N/A |

*Source:* NA, T 225/26, letter Lalor to Binnie,18th July 1946

*Note:* All costs are given in British pounds.

Several assumptions were made during these calculations. Firstly, working POW and non-working POW costs were equated in the absence of data. As mentioned above, working POW maintenance costs were lower, so costs are probably overestimated. Secondly, we assumed a constant POW labour force. Seasonal fluctuations, especially in rural employment, were considerable. The actual average number of POWs employed might differ, but probably not undercut the average used here. Thirdly, calculations are based on farm wages and do not take into account wages for other industries. Still, farming represented a major employment type and wages in other industries exceeded those in farm labour. The downward wage and upward cost bias thus show that potential profits might even have been greater. Fourthly, if we assume that actual average POW productivity may have been below the maximum productivity value of 75% used above, this would render a productivity of 50% and therefore a loss more likely. Still, in this case, employment would have reduced costs by $2 million. Moreover, German POW productivity would not have excessively high in order to attain a breakeven point fro the government. Using the numbers from this scenario, German POWs had to be 62% as productive as civilians.[27] Considering the evidence above, this value may actually have been attained. Finally, the revenue of $2.024 million yielded with 48% productivity approximates the figures stated in parliament, $2.125 million. While this implies that an overall loss would have been achieved, it nonetheless proves

[27] At breakeven, (12,375*x)-33,720*1.03 = 0. Solving for x yields x = 2.81. This represents 62% of the average market wage for 1945 above of $4.54.

the applicability of the model. Overall, the best case scenario proves that a profit from POW employment was possible.

## 3. Preliminary conclusion

The application of quantitative evidence to the profitability model suggests that Canada profited financially from POW labour during the Second World War. Data from British government files, POW productivity ranges and Canadian wage data were used to calculate profitability. In the best case scenario, POW employment in Canada netted a financial profit for the Canadian government. In the worst case, it substantially mitigated overall costs. The required breakeven productivity point for German POWs of 62% approximates actual findings of 48-57%.This would imply that the revenues derived from the third of the POW population which was working paid for the maintenance costs of the entire POW population.

The results appears even more remarkable considering the comparative POW cost structure of Canada. The model's variables appear unfavourable in the Canadian case due to under-usage of POW labour. 'Ardent Nazis', the majority of POWs in Canada, were an undesirable labour pool. Escape and sabotage risks necessitated high guarding and stirred political opposition to employment. German POW employment in Canada remained on a low scale because the government argued that the high costs in particular of security would exceed the benefit of employment.[28] Therefore, guarding costs exceeded those of most other Commonwealth countries and cost-saving civilian internee labour only constituted a minority of the POW labour force. Conversely, the evidence above indicates that, at least temporarily, German POW employment in Canada was profitable. Reasons for this include pressing labour demands necessitating tapping this labour pool and an efficient administration despite high costs due to the small scale of camps. Alternatively, $L$ could have been extraordinarily high to offset the high costs.

While data problems hamper further investigation, the fact that a country with unfavourable POW employment conditions – high $c$ and low $\alpha$ – could derive at least a gross profit from employment reflects the vast attention POW labour received and proves that POW labour could be profitable.

[28] Canadian Labour Gazette XLVI, 1946,p. 574