A Worked, Real-World Marxian Example
Football Manufacturing in Sialkot (Pakistan)

Standalone teaching note (with fully worked arithmetic)

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This document uses real, published numbers on Sialkot football manufacturing to build two concrete worked examples: (1) a hand-stitcher paid per ball; and (2) the per-ball cost structure of a Sialkot firm. Every calculation is shown step-by-step and explained in plain language.

1 Industry snapshot (why Sialkot matters)

Sialkot is a globally important production cluster for footballs. Bloomberg reports that the city produces about *70% of the world's soccer balls*, with roughly *1,000 factories* and about *60,000 people* working in the soccer ball manufacturing business.[1] Bloomberg also reports that *more than 80%* of Sialkot's soccer balls use *hand stitching*, though thermo-bonding is expanding.[2]

On exports: Pakistan's trade reporting (TDAP) lists football exports of about USD 254.0 million in FY2023–24 (and USD 237.0 million in FY2022–23).[3]

A Reuters report (reprinted by *Dawn*) adds two useful scale facts: Forward Sports said it made *5.5 million* Al Rihla balls, and the local chamber claimed *43 million balls valued at USD 191 million* were made in Sialkot in FY2021–22.[4]

2 What we will compute (and why the steps are so slow)

We will compute three things, carefully:

1. **Piece-rate wages in time form.** A "per ball" payment is just a wage in disguise. If we know how many hours it takes to stitch one ball, we can compute an hourly wage.

2. **Per-ball cost structure.** Using firm microdata, we will split the cost of one ball into *materials*, *overhead*, and *wages*.

3. **Marxian ratios in money form.** With those components, we compute:

$$k = c + v, \qquad s, \qquad e = \frac{s}{v}, \qquad r = \frac{s}{c+v}, \qquad \text{OCC} = \frac{c}{v}.$$

[1] Bloomberg Businessweek, "This Is Where Most of the World's Soccer Balls Come From" (Nov 22, 2022). https://www.bloomberg.com/features/2022-world-cup-soccer-ball-adidas-al-rihla-sialkot/

[2] Same Bloomberg source as above.

[3] TDAP, *Pakistan Trade Perspective* FY2023–24 and TDAP annual trade performance FY2022–23 (tables listing "Footballs"). https://tdap.gov.pk/wp-content/uploads/2025/01/TDAP-Annual-Report-PAKISTAN-TRADE-PERSPECTIVE-FY-23-24-new.pdf and https://tdap.gov.pk/wp-content/uploads/2023/10/Final-draft-of-Pakistans-Annual-Trade-Performance-July-June-FY23-6-SEPTEMBER-2023.pdf

[4] *Dawn* (Reuters), "'Made-in-Sialkot' ball puts Pakistan in FIFA World Cup" (Dec 9, 2022). https://www.dawn.com/news/1725468

3 Mini arithmetic primer (only what we need)

This section is intentionally basic.

(A) Multiplication

If you earn PKR 160 per ball and you stitch 3 balls:

$$160 \times 3 = 480.$$

That means PKR 480 total.

(B) Division

If you earned PKR 480 over 9 hours:

$$\frac{480}{9} \approx 53.33.$$

This is "PKR 53.33 per hour".

(C) Turning a ratio into a percent

If a number is 0.48 and you want percent:

$$0.48 \times 100 = 48\%.$$

4 Notation (definitions you can check)

We use standard Marxian accounting notation:

- c: **constant capital** (money spent on materials, energy, depreciation—inputs that transfer value to output).
- v: **variable capital** (wages: money spent on labour-power).
- k: **cost price**, defined as $k = c + v$.
- s: **surplus value**. In this document we will *approximate* s by observed accounting profit at the producing firm level, for a transparent first pass.
- e: **rate of exploitation**, $e = s/v$.
- r: **profit rate**, $r = s/(c + v)$.
- OCC: **organic composition proxy**, $\text{OCC} = c/v$.

Important limitation (stated up front): a low observed producer profit margin does *not* imply low exploitation. It can also reflect intense competition, buyer power, and value capture downstream (brands, logistics, retail). We will show this tension explicitly.

5 Worked Example 1: a hand-stitcher paid per ball (Bloomberg data)

Bloomberg reports the following for stitchers at manufacturer Anwar Khawaja Industries:

- payment per ball: $w_{\text{ball}} = \text{PKR } 160$ (about USD 0.75),
- time per ball: $t_{\text{ball}} = 3$ hours,
- output per day (typical): $q_{\text{day}} = 3$ balls,
- monthly earnings at that pace: about PKR 9,600,
- an estimated living wage for Sialkot: about PKR 20,000 per month.[5]

5.1 Step 1: daily earnings from a piece rate

Daily earnings are:

$$w_{\text{day}} = w_{\text{ball}} \times q_{\text{day}}.$$

Now substitute the numbers:

$$w_{\text{day}} = 160 \times 3.$$

Compute 160×3:

$$160 \times 3 = 480.$$

So:

$$w_{\text{day}} = \text{PKR } 480.$$

5.2 Step 2: implied working hours per day

If each ball takes 3 hours, and the stitcher completes 3 balls:

$$T_{\text{day}} = t_{\text{ball}} \times q_{\text{day}} = 3 \times 3 = 9 \text{ hours}.$$

So the stitching time alone is about 9 hours per day.

5.3 Step 3: hourly wage implied by the piece rate

Hourly wage is:

$$w_{\text{hour}} = \frac{w_{\text{day}}}{T_{\text{day}}}.$$

Substitute:

$$w_{\text{hour}} = \frac{480}{9}.$$

Do the division:

$$\frac{480}{9} \approx 53.33.$$

So:

$$w_{\text{hour}} \approx \text{PKR } 53.33/\text{hour}.$$

[5] Bloomberg Businessweek (Nov 22, 2022), as cited earlier.

5.4 Step 4: monthly earnings (showing the hidden assumption)

Bloomberg reports monthly earnings of about PKR 9,600 at this pace. We can recover the implied number of working days.

We already have $w_{\text{day}} = \text{PKR } 480$. Let the number of working days per month be D_{month}. Then:

$$w_{\text{month}} = w_{\text{day}} \times D_{\text{month}}.$$

We set $w_{\text{month}} = \text{PKR } 9{,}600$ and solve for D_{month}:

$$9{,}600 = 480 \times D_{\text{month}}.$$

Divide both sides by 480:

$$D_{\text{month}} = \frac{9{,}600}{480}.$$

Now compute:

$$\frac{9{,}600}{480} = 20.$$

So the implied working schedule is about:

$$D_{\text{month}} \approx 20 \text{ day/month}.$$

5.5 Step 5: compare to a living-wage benchmark

Living wage benchmark:

$$L_{\text{month}} = \text{PKR } 20{,}000/\text{month}.$$

Actual earnings:

$$w_{\text{month}} = \text{PKR } 9{,}600/\text{month}.$$

Compute the fraction:

$$\frac{w_{\text{month}}}{L_{\text{month}}} = \frac{9{,}600}{20{,}000}.$$

Divide numerator and denominator by 100 to simplify:

$$\frac{9{,}600}{20{,}000} = \frac{96}{200}.$$

Now divide:

$$\frac{96}{200} = 0.48.$$

Convert to percent:

$$0.48 \times 100 = 48\%.$$

So the reported monthly earnings are about:

$$48\% \text{ of the cited living-wage benchmark.}$$

5.6 Step 6: share of the retail price (Al Rihla launch price)

A contemporaneous report states the Al Rihla official match ball retailed at USD 165 on Adidas' US website at launch.[6]

Bloomberg reports stitchers get about USD 0.75 per ball. Let the stitcher's pay per ball be $w^{\$}_{\text{ball}} = 0.75$ and the retail price be $P^{\$}_{\text{retail}} = 165$.

[6] GOAL (Mar 30, 2022), retail price table. https://www.goal.com/en/news/adidas-world-cup-match-ball-al-rihla-qatar-2022/blta7dc0012ef2a879f

The share is:

$$\text{share} = \frac{w^{\$}_{\text{ball}}}{P^{\$}_{\text{retail}}} = \frac{0.75}{165}.$$

Compute the division:

$$\frac{0.75}{165} \approx 0.004545\ldots$$

Convert to percent:

$$0.004545\ldots \times 100 \approx 0.4545\%.$$

So, at launch pricing, the stitcher's pay is roughly:

0.45% of the retail price of an Al Rihla match ball.

5.7 Step 7: wage-hours needed to buy the commodity

How long must the stitcher work to buy back, at the retail benchmark, the kind of commodity this labour helps to produce?

First put the retail price into rupees. Step 6 used Bloomberg's dollar figure for pay, from 2022. Here we use one stated reference rate instead, PKR 279.897 per USD 1 (NBP Treasury rate sheet, 20 Jan 2026), so the two steps should not be read as a single conversion:

$$P_{\text{retail}} = 165 \times 279.897 \approx \text{PKR } 46{,}183.$$

Now divide by the hourly wage from Step 3. Call the result H, the wage-hours needed:

$$H = \frac{P_{\text{retail}}}{w_{\text{hour}}} \approx \frac{46{,}183}{53.33} \approx 866 \text{ hours}.$$

At 3 hours per ball, that is the time taken to stitch:

$$\frac{866}{3} \approx 289 \text{ balls}.$$

At 9 hours per day, it is:

$$\frac{866}{9} \approx 96.2 \text{ workdays}.$$

So, at these benchmarks, a worker would stitch about 289 balls, over about 96.2 nine-hour days, to earn the retail price of one.

How to read this. The benchmark is the official Al Rihla match ball, a premium product. So this measures the distance between the wage and that market price, and not the price of the particular ball this worker stitched. It also counts all of the wage towards the purchase, leaving nothing for food, rent or anything else.

5.8 A quick "order" calculation (1,000 balls)

Suppose a buyer places an order for $Q = 1{,}000$ hand-stitched balls at 160 rupees stitching pay each.

Total stitching wage bill for that order:

$$W_{\text{stitch}} = 160 \times 1{,}000.$$

Compute:

$$160 \times 1{,}000 = 160{,}000.$$

So:

$$W_{\text{stitch}} = \text{PKR } 160{,}000.$$

If each ball takes 3 hours, total stitching hours:

$$H_{\text{stitch}} = 3 \times 1{,}000 = 3{,}000 \text{ hours}.$$

This is useful later: it lets you translate piece-wages into labour-time at the batch scale.

6 Worked Example 2: per-ball cost structure (Atkin et al. microdata)

Now we move from one worker's wage to one firm's *per-ball* cost structure using microdata from Atkin et al. (NBER), based on a baseline survey of Pakistani soccer ball producers.[7]

6.1 The raw data (one size-5 promotional ball)

Atkin et al. report an input cost table ("Table A.1: input cost in rupees") for a size-5, two-layer promotional ball and note an exchange rate of about PKR 100 = USD 1 for their tabulation.[8]

Here are the per-ball money costs (rupees):

Cost item (per ball)	**Rupees**
Rexine (outer synthetic material)	39.68
Backing cloth	23.27
Latex	38.71
Bladder	42.02
Cutting labour	1.49
Stitching labour	39.24
Other labour	15.56
Overhead	10.84
Total cost (all items)	210.83

6.2 Step 1: classify items into c and v

We treat **materials** and **overhead** as constant capital c, and **labour** items as variable capital v.

So:

Constant capital c (materials + overhead).

$$c = 39.68 + 23.27 + 38.71 + 42.02 + 10.84.$$

Add step by step:

$$39.68 + 23.27 = 62.95$$

$$62.95 + 38.71 = 101.66$$

$$101.66 + 42.02 = 143.68$$

$$143.68 + 10.84 = 154.52$$

So:

$$c = \text{PKR } 154.52.$$

[7] Atkin, Khandelwal, Osman, and Pavcnik (2015), NBER Working Paper 21112. `https://www.nber.org/papers/w21112`

[8] Atkin et al. (2015), Appendix Table A.1 and note on exchange rate. `https://www.nber.org/papers/w21112`

Variable capital v (wages).

$$v = 1.49 + 39.24 + 15.56.$$

Add step by step:

$$1.49 + 39.24 = 40.73$$

$$40.73 + 15.56 = 56.29$$

So:

$$v = \text{PKR } 56.29.$$

Check: $k = c + v$.

$$k = c + v = 154.52 + 56.29 = 210.81.$$

This is (up to rounding of cents) the reported total 210.83. Small differences like 0.02 happen because the table entries are rounded to two decimals.

6.3 Step 2: a profit margin (what Atkin et al. report)

Atkin et al. also report profit margins; for size-5 promotional balls, a mean "profit (%)" around 8.1% is shown in their table.[9] They also state the conversion they use: *unit cost* is recovered by dividing price by 1+ (profit margin), which means the margin is a **markup on cost**.[10]

So we will treat:

$$m = 0.081$$

as the (mean) profit markup on cost for this illustrative ball.

6.4 Step 3: compute an implied producer selling price

If markup on cost is m, then:

$$p = k(1 + m).$$

Use $k = 210.83$ and $m = 0.081$:

$$p = 210.83(1 + 0.081) = 210.83 \times 1.081.$$

Now compute 210.83×1.081 carefully by splitting 1.081:

$$1.081 = 1 + 0.081.$$

So:

$$210.83 \times 1.081 = 210.83 \times 1 + 210.83 \times 0.081.$$

The first term is just 210.83.

Now compute the second term:

$$210.83 \times 0.081 = 210.83 \times \frac{81}{1000}.$$

First compute 210.83×81:

$$210.83 \times 81 = 210.83 \times 80 + 210.83 \times 1.$$

[9] Atkin et al. (2015), Table of average prices and profit percentages for ball types (e.g. size-5 promotional). `https://www.nber.org/papers/w21112`

[10] Atkin et al. (2015), note describing "divide its reported price by one plus its reported profit margin" to obtain unit cost. `https://www.nber.org/papers/w21112`

$$210.83 \times 80 = (210.83 \times 8) \times 10.$$

Compute 210.83×8:

$$210.83 \times 8 = 1686.64.$$

So:

$$210.83 \times 80 = 1686.64 \times 10 = 16866.40.$$

Add the $\times 1$ part:

$$210.83 \times 81 = 16866.40 + 210.83 = 17077.23.$$

Now divide by 1000:

$$210.83 \times 0.081 = \frac{17077.23}{1000} = 17.07723.$$

So the price is:

$$p = 210.83 + 17.07723 = 227.90723.$$

Rounded to two decimals:

$$p \approx \text{PKR } 227.91 \quad \text{(producer selling price per ball)}.$$

6.5 Step 4: compute s as the per-ball accounting profit

Accounting profit per ball is:

$$\pi = p - k.$$

Substitute:

$$\pi = 227.90723 - 210.83 = 17.07723.$$

In this simplified first pass, we set:

$$s \approx 17.08.$$

6.6 Step 5: compute the Marxian ratios

Now we compute:

$$e = \frac{s}{v}, \quad r = \frac{s}{c+v}, \quad \text{OCC} = \frac{c}{v}.$$

(A) Rate of exploitation $e = s/v$.

$$e = \frac{17.07723}{56.29}.$$

A quick long-division approximation:

$$56.29 \times 0.30 = 16.887 \quad \text{(slightly below 17.07723)},$$

difference:

$$17.07723 - 16.887 = 0.19023.$$

Now add 0.003 more:

$$56.29 \times 0.003 = 0.16887,$$

new difference:

$$0.19023 - 0.16887 = 0.02136.$$

Add 0.0003 more:

$$56.29 \times 0.0003 = 0.016887,$$

difference:

$$0.02136 - 0.016887 = 0.004473.$$

So we are at 0.3033 with a tiny remainder. Therefore:

$$e \approx 0.303 \approx 30.3\%.$$

(B) Profit rate $r = s/(c+v)$. Here $c + v \approx 210.83$, so:

$$r = \frac{17.07723}{210.83} \approx 0.081 = 8.1\%.$$

(This matches the assumed markup construction.)

(C) Organic composition proxy $\mathrm{OCC} = c/v$.

$$\mathrm{OCC} = \frac{154.52}{56.29}.$$

Compute:

$$56.29 \times 2 = 112.58, \quad \text{remainder } 154.52 - 112.58 = 41.94.$$

Now:

$$56.29 \times 0.7 = 39.403, \quad \text{remainder } 41.94 - 39.403 = 2.537.$$

Now:

$$56.29 \times 0.04 = 2.2516, \quad \text{remainder } 2.537 - 2.2516 = 0.2854.$$

Now:

$$56.29 \times 0.005 = 0.28145, \quad \text{remainder } 0.2854 - 0.28145 \approx 0.00395.$$

So:

$$\mathrm{OCC} \approx 2.745 \approx 2.75.$$

6.7 Step 6: "necessary" vs "surplus" shares (labour-time intuition without MELT)

Even if you do not know the MELT, one identity is helpful.

New value (in money terms) created in production is:

$$\text{new value} = v + s.$$

Here:

$$v + s \approx 56.29 + 17.08 = 73.37.$$

Wage share of new value:

$$\frac{v}{v+s} = \frac{56.29}{73.37} \approx 0.767 = 76.7\%.$$

Surplus share:

$$\frac{s}{v+s} = \frac{17.08}{73.37} \approx 0.233 = 23.3\%.$$

In labour-time language, these shares correspond to:

$$\frac{T_n}{T} = \frac{1}{1+e}, \qquad \frac{T_s}{T} = \frac{e}{1+e}.$$

With $e \approx 0.303$:

$$\frac{T_n}{T} \approx \frac{1}{1.303} \approx 0.767, \quad \frac{T_s}{T} \approx \frac{0.303}{1.303} \approx 0.233.$$

So, *if* the relevant working day were, say, $T = 9$ hours, then:

$$T_n \approx 0.767 \times 9 \approx 6.90 \text{ hour}, \qquad T_s \approx 0.233 \times 9 \approx 2.10 \text{ hours}.$$

That is: roughly 6.9 hours to reproduce wages, and 2.1 hours as surplus labour time—under the simplifying assumption that the money shares reflect value shares and that the ratios apply uniformly across the direct labour in this production process.

7 Scaling up: from a ball to the Sialkot cluster (transparent approximations)

Here we take published scale facts and do simple "back-of-the-envelope" totals. The point is not precision; the point is to show exactly what assumptions you must make, and how each assumption changes the result.

7.1 Step 1: average export value per ball (Reuters/Dawn numbers)

Reuters (via *Dawn*) reports a chamber claim: 43 million balls valued at USD 191 million (FY2021–22).[11]

Average value per ball is:

$$\overline{P} = \frac{191{,}000{,}000}{43{,}000{,}000}.$$

Cancel six zeros by dividing numerator and denominator by 1,000,000:

$$\overline{P} = \frac{191}{43}.$$

Now divide 191 by 43:

$$43 \times 4 = 172, \quad \text{remainder } 191 - 172 = 19.$$

So:

$$\frac{191}{43} = 4 + \frac{19}{43}.$$

And:

$$\frac{19}{43} \approx 0.44186.$$

So:

$$\overline{P} \approx 4.44 \text{ USD/ball}.$$

Interpretation: the average value per ball at that scale is about USD 4.44.

7.2 Step 2: total stitching wage bill under two piece-rate scenarios

We will compute two *stitching-only* wage-bills:

Scenario A (high-end hand stitching; Bloomberg). Bloomberg reports about USD 0.75 stitching pay per ball.[12] Then stitching wage bill for $Q = 43$ million balls is:

$$W^A_{\text{stitch}} = 0.75 \times 43{,}000{,}000.$$

Compute:

$$0.75 \times 43{,}000{,}000 = \frac{3}{4} \times 43{,}000{,}000 = 32{,}250{,}000.$$

So:

$$W^A_{\text{stitch}} \approx 32.25 \text{ million USD}.$$

[11] *Dawn* (Reuters) (Dec 9, 2022), as cited earlier.

[12] Bloomberg Businessweek (Nov 22, 2022), as cited earlier.

Scenario B (promotional ball stitching cost; Atkin et al.). Atkin et al. report stitching labour cost PKR 39.24 per ball, and use PKR 100 = USD 1 for their tabulation.[13] So stitching labour cost in dollars (for their dataset) is approximately:

$$w_{\text{ball}}^{B} \approx \frac{39.24}{100} = 0.3924 \text{ USD/ball.}$$

Now multiply by 43 million balls:

$$W_{\text{stitch}}^{B} = 0.3924 \times 43{,}000{,}000.$$

Compute 0.3924×43 first:

$$0.3924 \times 40 = 15.696, \qquad 0.3924 \times 3 = 1.1772.$$

Add:

$$15.696 + 1.1772 = 16.8732.$$

So:

$$W_{\text{stitch}}^{B} \approx 16.8732 \text{ million USD.}$$

7.3 Step 3: compare stitching wages to the export value

Export value (Reuters/Dawn chamber claim): USD 191 million.

Scenario A share.

$$\text{share}^{A} = \frac{32.25}{191} \approx 0.1689 = 16.9\%.$$

Scenario B share.

$$\text{share}^{B} = \frac{16.87}{191} \approx 0.0883 = 8.8\%.$$

So stitching wages alone are somewhere between about 9% and 17% of export value *under these two very different ball types / wage regimes.* This is not a contradiction: it reflects product heterogeneity (cheap vs premium balls), technology choice (machine vs hand stitching), and buyer-driven price pressure.

7.4 A note on why producer profit margins can be low while retail prices are high

Atkin et al. report producer profit margins on the order of single digits (around 8% in the example table), which is compatible with fierce competition among suppliers.[14] Meanwhile, retail pricing for the branded match ball can be on the order of USD 165.[15] That wedge is where downstream costs and profits sit: branding, sponsorship, distribution, retail markups, and (often) monopoly rents. This document does not "solve" that wedge; it makes it visible and computable.

[13] Atkin et al. (2015), Appendix Table A.1 and exchange-rate note.
[14] Atkin et al. (2015), profit table, as cited earlier.
[15] GOAL (Mar 30, 2022), as cited earlier.

8 Historical note (labour regulation and the child-labour scandal)

For context: the Sialkot cluster became a major site of international scrutiny over child labour in the 1990s, followed by monitoring and restructuring initiatives.[16] This history matters because it shaped subcontracting patterns, home-based work, and compliance regimes that still structure how piece-rate labour is organised.

9 What you can change (and recompute immediately)

If you want to adapt this to a specific pamphlet chapter, or to a different ball type, change these inputs and redo the same steps:

- piece rate per ball (w_{ball}),
- hours per ball (t_{ball}),
- balls per day (q_{day}),
- cost table (materials, overhead, wage items),
- markup / profit margin (m),
- annual output volume (Q) and export value (for scaling).

References (quick list)

References

[1] Bloomberg Businessweek (2022). "This Is Where Most of the World's Soccer Balls Come From" (Nov 22, 2022). https://www.bloomberg.com/features/2022-world-cup-soccer-ball-adidas-al-rihla-sialkot/

[2] Trade Development Authority of Pakistan (TDAP) (2025). *Pakistan Trade Perspective FY 2023–24.* https://tdap.gov.pk/wp-content/uploads/2025/01/TDAP-Annual-Report-PAKISTAN-TRADE-PERSPECTIVE-FY-23-24-new.pdf

[3] Trade Development Authority of Pakistan (TDAP) (2023). *Pakistan's Annual Trade Performance July–June FY 2022–23.* https://tdap.gov.pk/wp-content/uploads/2023/10/Final-draft-of-Pakistans-Annual-Trade-Performance-July-June-FY23-6-SEPTEMBER-2023.pdf

[4] Atkin, D., Khandelwal, A. K., Osman, A., & Pavcnik, N. (2015). "Exporting and Firm Performance: Evidence from a Randomized Experiment." NBER Working Paper 21112. https://www.nber.org/papers/w21112

[5] *Dawn* (Reuters) (2022). "'Made-in-Sialkot' ball puts Pakistan in FIFA World Cup" (Dec 9, 2022). https://www.dawn.com/news/1725468

[6] GOAL (2022). "Adidas unveils 'fastest in flight' World Cup match ball Al Rihla" (Mar 30, 2022). https://www.goal.com/en/news/adidas-world-cup-match-ball-al-rihla-qatar-2022/blta7dc0012ef2a879f

[16] For one overview: UNIDO (2010), Khalid Nadvi, "The Soccer Ball Cluster of Sialkot, Pakistan" (PDF). https://www.unido.org/sites/default/files/files/2010-12/GC.13_10_Ebook_part2.pdf

[7] UNIDO (2010). Khalid Nadvi, "The Soccer Ball Cluster of Sialkot, Pakistan" (PDF). https://www.unido.org/sites/default/files/files/2010-12/GC.13_10_Ebook_part2.pdf