

Affirmative Action in India via Vertical, Horizontal, and Overlapping Reservations

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Reservation System in India

- 1950 Constitution of India sanctions affirmative action.
 - government jobs
 - positions at public universities
 - legislative seats
- For each of a numbers of disadvantaged groups, a fraction of positions are **reserved**.
- Higher level provisions
 - Original Beneficiaries: Scheduled Castes (SC), Scheduled Tribes (SC)
 - Other Backward Classes (OBC), Economically Weaker Section (EWS)
- Lower level provisions
 - Persons with disabilities, women, ex-servicemen, etc.

Introduction of Vertical and Horizontal Reservations

- The concepts of vertical and horizontal reservations are introduced in the landmark Supreme Court judgement *Indra Sawhney and others v. Union of India (1992)*, also known as the *Mandal Commission Case*.

"A little clarification is in order at this juncture: all reservations are not of the same nature. There are two types of reservations, which may, for the sake of convenience, be referred to as 'vertical reservations' and 'horizontal reservations'. The reservation in favour of scheduled castes, scheduled tribes and other backward classes [under Article 16(4)] may be called vertical reservations whereas reservations in favour of physically handicapped [under clause (1) of Article 16] can be referred to as horizontal reservations. Horizontal reservations cut across the vertical reservations – what is called interlocking reservations."

Indra Sawhney (1992): Vertical (Social) Reservations

- Vertical reservations (or **VR protections**) correspond to provisions sanctioned under Article 16(4) of the Constitution.
- Intended for historically discriminated groups such as SC, ST, OBC.
- To be earmarked in the form of an **set aside**: Positions secured on the basis of merit **do not count** against VR-protected positions.

“In this connection it is well to remember that the reservations under Article 16(4) do not operate like a communal reservation. It may well happen that some members belonging to, say Scheduled Castes get selected in the open competition field on the basis of their own merit; they will not be counted against the quota reserved for Scheduled Castes; they will be treated as open competition candidates.”

Indra Sawhney (1992): Horizontal (Special) Reservations

- Horizontal reservations (or **HR protections**) correspond to provisions sanctioned under Article 16(1) of the Constitution.
- Intended for other disadvantaged groups such as persons with disabilities, women, etc.
- Provided as a **minimum guarantee**: Positions secured on the basis of merit **do count** against HR-protected positions.

Stand-Alone Implementation of VR Protections

- Individuals can belong to at most one VR-protected category in India.
- In the absence of HR protections, this structure makes implementation of VR protections straightforward with the following procedure.

Over-and-Above Choice Rule (Dur et al. 2018)

Step 1. Allocate open positions to highest merit-ranking individuals.

Step 2. For each VR-protected group, allocate the reserved positions to highest merit-ranking members of the group who remain unassigned.

Concurrent Implementation of VR and HR Protections

- Most applications in the field, however, also involve HR protections.
 - 4-5% of positions are HR protected for **persons with disabilities**
 - 30-35% of positions are HR protected for **women** in several states
- Moreover, HR-protected groups overlap with VR-protected groups. Therefore, it is less clear how the two policies can be implemented together.
- While *Indra Sawhney (1992)* clearly lays out the principles that guide stand-alone implementation of either policy, it does not provide guidance on their concurrent implementation.

Anil Kumar Gupta v. State of U.P. (1995)

- This gap has later been filled by another judgment of the Supreme Court in *Anil Kumar Gupta v. State of U.P. (1995)*, where the following procedure is devised and enforced in India.

SCI-ACG Choice Rule

Step 1. Derive a tentative outcome using the over-and-above choice rule.

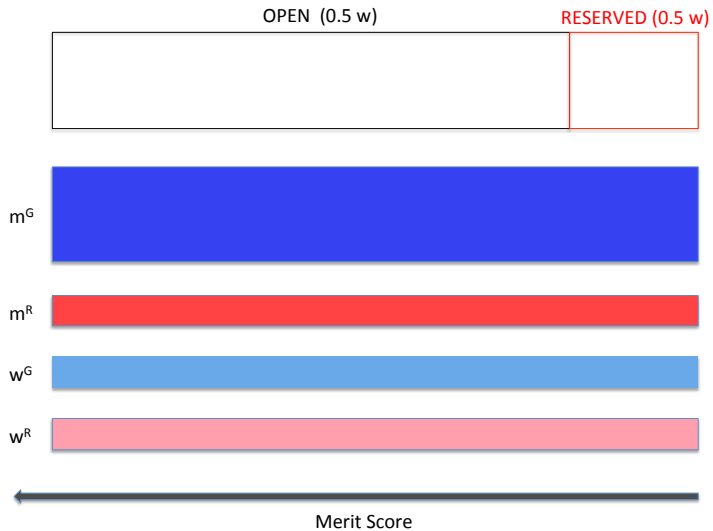
Step 2. Utilizing individuals who are not VR-protected, make any necessary adjustments to recipients of the open positions to accommodate HR protections within open positions.

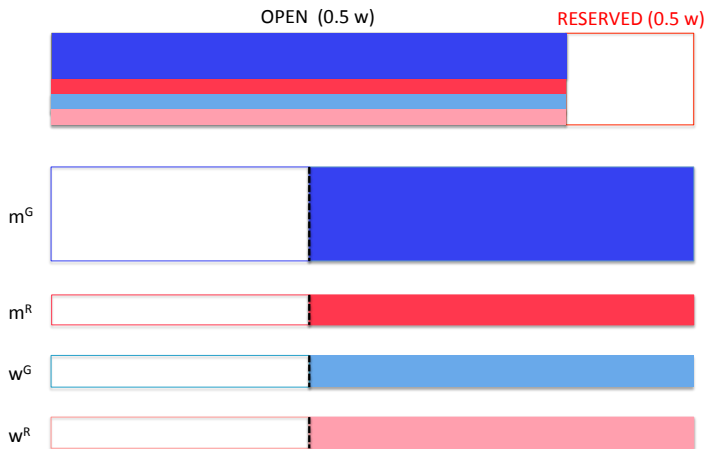
Step 3. Make any necessary adjustments to recipients of the VR-protected positions to accommodate

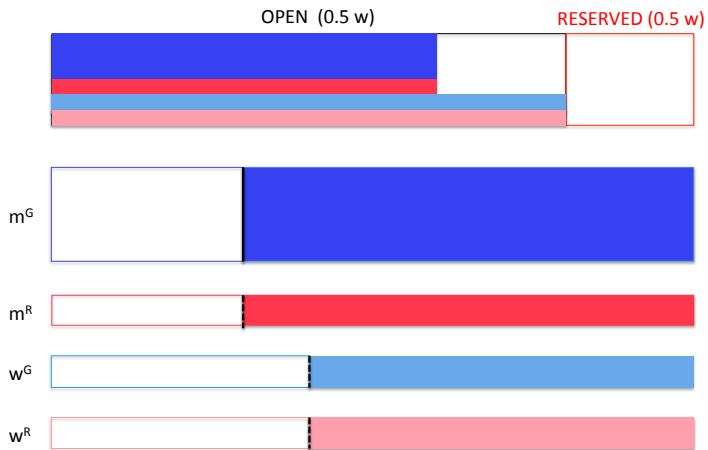
- higher merit-ranking VR-protected candidates who lost their tentative open positions in Step 2, and*
- HR protections within VR-protected positions.*

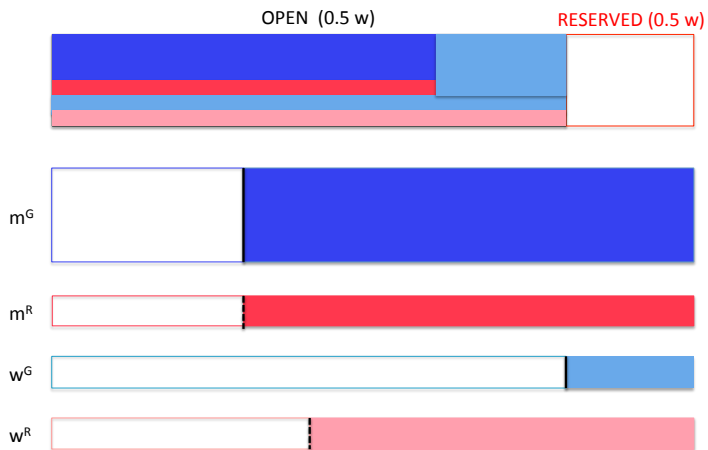
Failure of the SCI-AKG Choice Rule

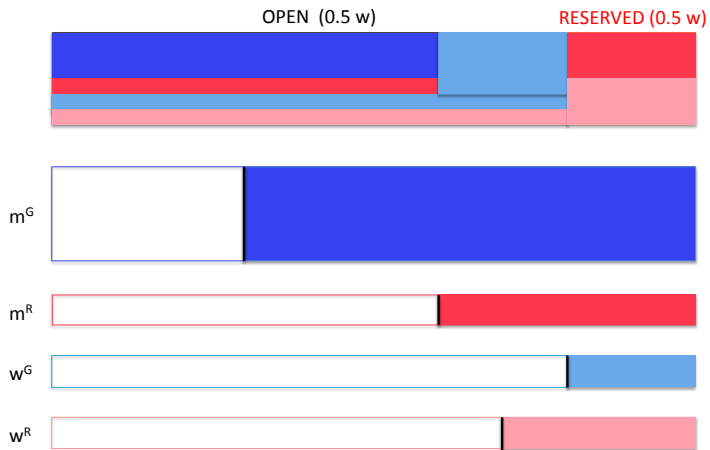
- A critical mandate in this judgement, however, has introduced a number of anomalies into the procedure, sparking thousands of litigations in India for the next 25 years.
- Most critically, the SCI-AKG choice rule fails the following two properties, often generating unintuitive outcomes at odds with the philosophy of affirmative action.
 - **No Justified Envy**: A higher-merit-ranking individual cannot lose a position to a lower-merit-ranking individual, unless the latter is of strictly lower privilege.
 - **Incentive Compatibility (Aygün & Bó 2021)**: An individual never loses a position solely due to declaring her reserve-eligible attributes.
- The **root cause** of the failure is the denial of VR-protected individuals their open category HR protections, if they claim their VR protections.











Resistance to Implement SCI-AKG Choice Rule

In numerous cases, public institutions resisted adopting the Supreme Court-mandated procedure and allowed reserved category candidates to benefit from open category HR protections.

Often they faced litigation from lower merit-ranking general category candidates who are not selected.

1. *Rajeshwari vs State (2013)*, Rajasthan High Court.
 - Large scale litigation with 120 petitions against the State of Rajasthan.
 - State allowed reserved category women to benefit from open category HR protections.
 - High Court ruled that the State is at fault, and ordered the State to adopt the Supreme Court-mandated procedure.

2. *Ashish Kumar Pandey (2016)*, Allahabad High Court.

- Case mimics *Rajeshwari vs State (2013)*: 25 petitioners litigate against the State of Uttar Pradesh for allowing reserved category women to benefit from open category HR protections.
- **Polarizing case**: The counsel for petitioners argued that the error was intentional:

*"The action of the Board is not only motivated, but purports to take forward the **unwritten agenda** of the State Government to accommodate as many number of OBC/SC candidates in the open category."*

- The judge of the case ruled that the State must correct their erroneous application of HR protections, emphasizing that the State has played foul:

*“There is merit in the submission of the learned counsel for the petitioners that the conduct of the members of the Board appears not only mischievous but motivated to achieve a **calculated agenda** by deliberately keeping meritorious candidates out of the select list. . .*

*I am constrained to hold that both the State and the Board have played **fraud** on the principles enshrined in the Constitution with regard to public appointment.”*

- The State appealed the judgement and lost the appeal as well.

3. *Smt. Megha Shetty (2013)*, Rajasthan High Court.

- Case is similar to earlier ones: A general category petitioner litigated against the State for allowing reserved category women to benefit from open category HR protections.
- Unlike the earlier ones, the case is dismissed at the High Court.
- The petitioner appealed the decision, bringing the case to a larger bench of the High Court.
- The appeal is also dismissed. As apparent from the court proceedings, the judges had difficulty entertaining the possibility that a procedure mandated by the Supreme Court could possibly allow for justified envy:

"The outstanding and important feature to be noticed is that it is not the case of the appellant-petitioner that she has obtained more marks than those 8 OBC (Woman) candidates..."

Litigations Due to Failure of No Justified Envy

In numerous other cases, a public institution that used the Supreme Court-mandated procedure faced litigation from reserved category candidates who are not selected despite having higher merit scores than their general category counterparts who are selected.

4. *Asha Ramnath Gholap (2016)*, Bombay High Court.

- Following the law, State used the Supreme Court-mandated choice rule, which resulted in an instance of justified envy.
- A reserved category petitioner brought the case to the High Court.
- The judges granted the petition stating that a candidate cannot be denied an open category position based on her reserved category membership.

Wrongful Implementation & Possible Misconduct

While applicants are entitled to declare their social categories or traits, they are not required to. Since the SCI-AKG choice rule is not incentive compatible, withholding this information may make sense.

5. *Shilpa Sahebrao Kadam (2019)*, Bombay High Court.

- Several candidates withheld their reserved category memberships, so they could take advantage of the open category HR protections.
- Authorities requested personal information to identify their reserved category memberships, and evaluated their applications as if these candidates claimed their VR protections.
- The candidates were all denied positions despite having higher merit scores than their general category counterparts who are selected due to open category HR protections. So they went to court.

- The petitioners lost the case despite the “faulty” implementation!
- Indeed, the faulty implementation seems to be **systematic** and **intentional** as revealed by the court proceedings.

“According to Respondent - Maharashtra Public Service Commission, in view of the Circular dated 13.08.2014, only the candidates belonging to open (Non-reserved) category can be considered for open horizontally reserved posts meaning thereby, the reserved category candidates cannot be considered for open horizontally reserved post. Reference is made to a communication issued by the Additional Chief Secretary (Service) of the State of Maharashtra dated 26.07.2017, whereunder it is prescribed that a female candidate belonging to any reserved category, even if tenders application form seeking employment as an open category candidate, the name of such candidate shall not be recommended for employment against a open category seat.”

Loss of Access to Open Category HR Protections, Despite Lack of Access to VR Protections

6. *Tejaswini Raghunath Galande (2019)*, Bombay High Court.
 - The petitioner declared her reserved category membership despite the lack of VR-protected positions for her category.
 - She lost access to open category HR protections, which in turn resulted in an instance of justified envy.
 - Prior to bringing her case to the High Court, she filed a petition to a lower court. Her case was dismissed.
 - She appealed at the High Court, which in turn was granted.
 - There are similar petitions which have been dismissed.

How Many Lawsuits Are There?



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horizontal reservation doctypes: supremecourt,scorders,hig

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orissa

uttaranchal

Authors

A Bhushan

[Anil Kumar Gupta, Etc vs State Of Uttar Pradesh And Ors on 28 July, 1995](#)

directed to say clarifying the Govt. policy that **horizontal reservation** be granted in all medical colleges on total seats ... reservations and not vertical reservations. The corrigendum stated: ".....following **horizontal reservation** has been provided on the total seats
[Supreme Court of India - Cites 8 - Cited by 132 - Full Document](#)

[Smt. Megha Shetty vs State Of Raj. & Anr on 26 July, 2013](#)

other 3 similar matters) being allotted as per the **horizontal reservation** provided for Woman (General) and 4 women candidates ... fact, the controversy related to the operation of **horizontal reservation** provided to woman and not the vertical reservations provided
[Rajasthan High Court - Jodhpur - Cites 18 - Cited by 78 - Full Document](#)

[Public Service ... vs Mamta Bisht And Ors on 3 June, 2010](#)

reservation in favour of SC/ST/OBC and **horizontal reservation** in favour of handicapped, and women etc. belonging to Uttaranchal ... category while others had been given the benefit of **horizontal reservation** being resident of Uttaranchal. Respondent No.1, being aggrieved
[Supreme Court of India - Cites 3 - Cited by 43 - Full Document](#)

[Rajesh Kumar Daria vs Rajasthan Public Service ... on 18 July, 2007](#)

Rules. They contended that though the Rules provided for **horizontal reservation** of 20% for women categorywise, RPSC while preparing ... subsequent year and the **reservation** treated as **horizontal reservation**, i.e. the **reservation** of women candidates shall be adjusted proportionately
[Supreme Court of India - Cites 7 - Cited by 59 - Full Document](#)

[Dr. Ravindra Kumar Pandey Son Of ... vs State Of U.P. Through Secretary ... on 3 July, 2006](#)

ground that the Commission has not provided **horizontal reservation** to physically handicapped candidates and if such **reservation** would have been ... senior counsel for the petitioner has urged that 3% **horizontal reservation** exists for the physically handicapped candidates, the quota
[Allahabad High Court - Cites 12 - Cited by 7 - Full Document](#)

Related Queries

horizontal reservation

vertical reservation

special reservation

reservation quota

article 16

Interruptions in Recruitment Due to Litigations

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THE TIMES OF INDIA

General seat vacated by quota candidate remains general: High Court

TNN | Mar 16, 2017, 04:00 AM IST



AHMEDABAD: Gujarat high court on Wednesday ruled that only a general category candidate can be appointed to a seat in open category in a government job, once it is vacated by a candidate from a reserved category.

In the instant case, a meritorious candidate from SC/ST category had first opted for appointment as a candidate in general category. But later, the candidate decided to vacate the seat after securing his/her seat in the concerned reserved category. The question arose whether the vacant seat should be filled with a candidate from reserved category or general category.

The HC has said that such a seat should be filled by a candidate of general category only, said advocate Dimple Thaker who represented the candidates.

In holding so, a bench of Chief Justice R S Reddy and Justice V M Pancholi has said that the Supreme Court's order in Jitendra Kumar Singh v/s the state of Uttar Pradesh cannot be made applicable in Gujarat. This is because the order was based on rules prevailing in UP, whereas Gujarat has different rules.

This issue has further complicated the recruitment process being undertaken by the Gujarat Public Service Commission (GPSC) for the posts of assistant conservator of forest (ACF) and range forest officer (RFO).

Interestingly, the forest department is recruiting on these posts after a long gap of 26 years. The advertisement was issued in 2010 and recruitment took place in 2016 amid too many litigations over the issue of reservation. A major issue, that of women reservation, is yet to be decided by the court.

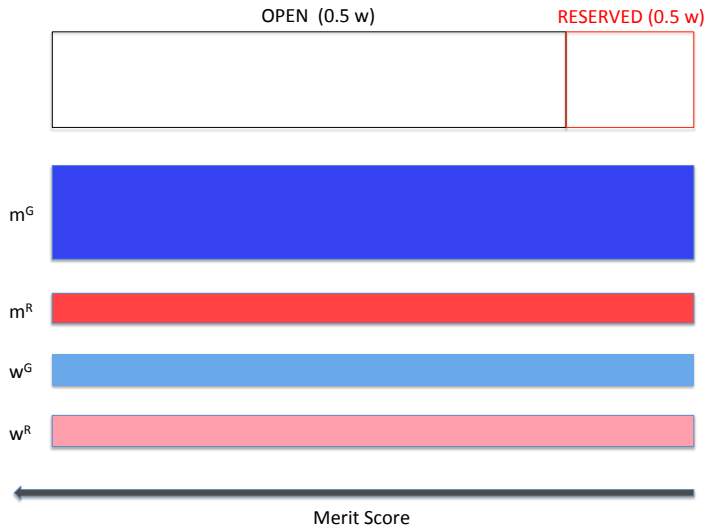
With the recent observation by the HC, the merit list will now be changed for the third time. Those already selected and at present under training might lose their jobs, and half a dozen new candidates might find their names on the new list. However, all appointments have been made by the HC conditionally and subject to final outcome of these multiple litigations.

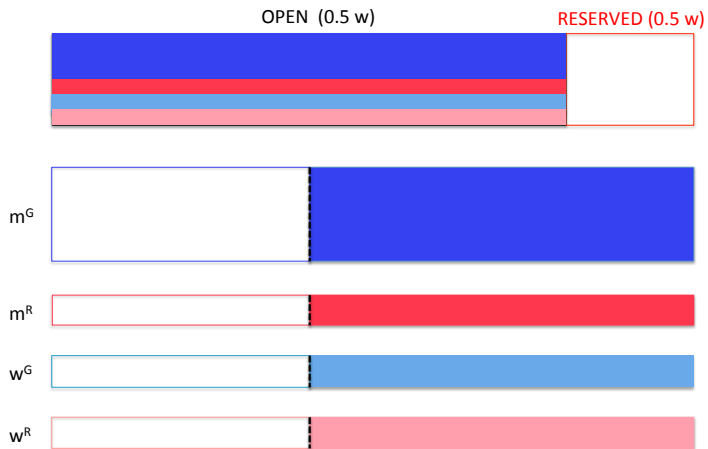
An Easy Fix: Two-Step Minimum Guarantee Choice Rule

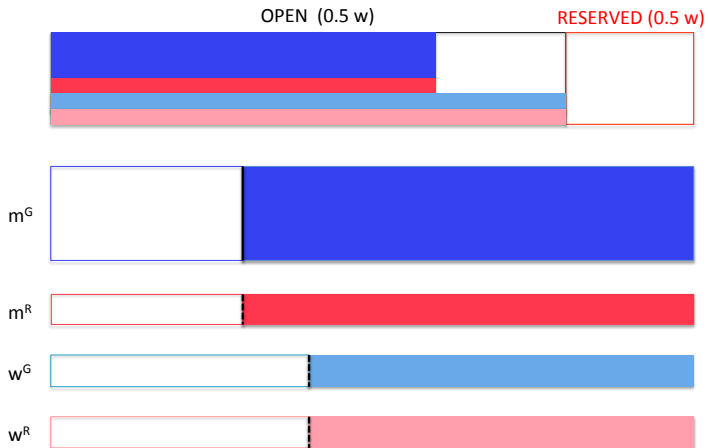
- Since the root cause of the crisis is the denial of VR-protected individuals their open category HR protections, following the basic principles of minimalist market design, a resolution lies in the removal of this restriction.
- First focusing on the case where HR-protected groups do not overlap, we refer to choice rule as the **two-step minimum guarantee (2SMG)** choice rule.
 - The SCI-AKG choice rule is not well-defined when HR-protected groups overlap.

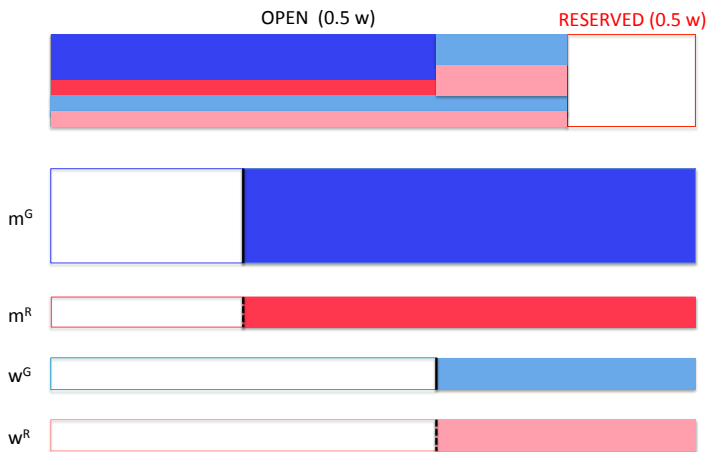
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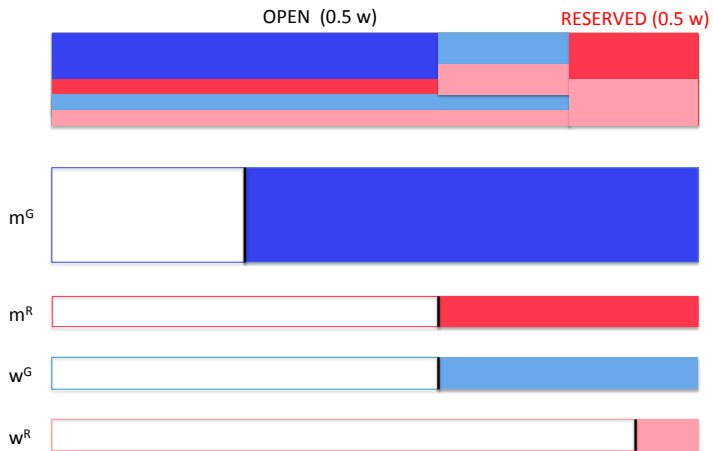
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- First focusing on the case where HR-protected groups do not overlap, we refer to choice rule as the **two-step minimum guarantee (2SMG)** choice rule.
 - The SCI-AKG choice rule is not well-defined when HR-protected groups overlap.
- **Proposition:** The 2SMG choice rule satisfies *no justified envy* and *incentive compatibility*.











2020 Supreme Court Resolution of the Crisis

- Despite the large scale disarray it created in the country for a quarter of a century, the failure of the SCI-AKG choice rule was never addressed by the Supreme Court prior to the March 2019 circulation of the first draft of Sönmez & Yenmez (2022).
- The ongoing crisis due to the flawed choice rule was our primary motivation when we started this project and proposed the 2SMG choice rule as a minimalist remedy.
- A landmark December 2020 judgment by a three-judge bench of the Supreme Court not only addressed the failure of the SCI-AKG choice rule, but also reshaped some of the questions of interest for our paper while it was under review for scholarly publication.

Saurav Yadav v. State of Uttar Pradesh (2020)

The Indian EXPRESS

Home / Opinion / Columns / SC verdict exposes fallacy of using general category as reservation for upper castes

SC verdict exposes fallacy of using general category as reservation for upper castes

PB Mehta writes: What the Court is trying to do, in an interesting way, is to argue that for its purposes, the opposition between merit and reservation needs to be deconstructed — not because there is no such thing as merit (as defenders of reservation claim), or because there should not be reservation (as critics of reservation claim).



Legislature Is Eptimized By An Unproductive Parliament
Executive Power Is Controlled By Politicians
Judiciary Is Outdated And Backlogged
Media Is Biased And Has No Freedom Of Speech

While The Four Voices Of Democracy Are Amoral
A '5th VOICE' Is Born. Voice By The People, For The People

Supreme Court's Adjudication On Merit And Reservations (Saurav Yadav V. State Of Uttar Pradesh; Horizontal Reservation V. Vertical Reservation.)

News By/Courtesy: Parimala Ronanki | 02 Apr 2021 12:18pm IST



TAX & LEGAL

MY VOICE



reserve category contempt with general category.

HIGHLIGHTS

THE WIRE English हिंदी मराठी اردو

ANALYSIS LAW

How the Supreme Court Blocked Attempts to Dilute Merit Under the Open Category

In *Saurav Yadav v State of Uttar Pradesh*, the apex court's three-judge bench explained how merit is served by permitting candidates belonging to reserved categories compete with 'general' candidates.



Photo: Paripash Chakrabarty



V. Venkatesan

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Last Friday's judgment by a three-judge bench of the Supreme Court in *Saurav Yadav v State of Uttar Pradesh* is a significant addition to the discourse on reservations.

THE LEAFLET

CONSTITUTION FIRST

Analysis Caste Rights Fundamental Rights Social Justice

Supreme Court strikes down policy of excluding the reserved community from competing for general and open category

BY DR. PUNEETH PUTTAIAH — JANUARY 25, 2021

Saurav Yadav v. State of Uttar Pradesh (2020)

- Using arguments parallel to our analysis, the justices reached the same conclusions in *Saurav Yadav v. State of Uttar Pradesh (2020)* as we have earlier reached in our analysis.
- Most notably, with this recent judgment:
 1. *No justified envy* is mandated for all choice rules used in India.
 2. Long-standing SCI-AKG choice rule is rescinded due to its failure to satisfy *no justified envy*.
 3. As a possible replacement for the SCI-AKG choice rule, the 2SMG choice rule is endorsed, although it is not explicitly mandated.
 4. Clarity is brought to implementation of VR protections in the presence of HR protections at a level that was not available before.
- **External validity** for minimalist market design.

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 4. Clarity is brought to implementation of VR protections in the presence of HR protections at a level that was not available before.
- **External validity** for minimalist market design.
- In order to elaborate on the broader implications of this reform in India, we proceed our presentation with a formal analysis.

Basics

- q # of identical positions
- \mathcal{I} set of individuals
 - each individual is in need of one position
 - each individual $i \in \mathcal{I}$ is endowed with a distinct merit score $\sigma(i) \in \mathbb{R}_+$

Basics

- q # of identical positions
- \mathcal{I} set of individuals
 - each individual is in need of one position
 - each individual $i \in \mathcal{I}$ is endowed with a distinct merit score $\sigma(i) \in \mathbb{R}_+$
- While individuals with higher merit scores have higher claims for a position in the absence of affirmative action (AA) policies, disadvantaged groups are protected through two types of AA policies:
 - (i) Vertical Reservations (VR) providing VR protections, and
 - (ii) Horizontal Reservations (HR) providing HR protections

Vertical Reservations

- VR policy is managed through a system of category membership.
- \mathcal{R} set of **reserve-eligible categories**
- g a **general category** for those ineligible for VR protections
- $\rho : \mathcal{I} \rightarrow \mathcal{R} \cup \{\emptyset\}$ (reserve-eligible) category membership function
 - Each individual belongs to a single category in $\mathcal{R} \cup \{g\}$
 - $\rho(i) = c$ indicates i belongs to the reserve-eligible category $c \in \mathcal{R}$
 - $\rho(i) = \emptyset$ indicates i belongs to the general category g

Vertical Reservations

- q^c # of **category- c** positions set aside for members of $c \in \mathcal{R}$
 - For any reserve-eligible category $c \in \mathcal{R}$, an individual $i \in \mathcal{I}$ is **eligible for category- c positions** if $\rho(i) = c$.
- $q^o = q - \sum_{c \in \mathcal{R}} q^c$ # of **open category** (or **category- o**) positions
 - All individuals are **eligible for open category positions**.
- $\mathcal{V} = \mathcal{R} \cup \{o\}$ set of **vertical categories for positions**
- $\mathcal{I}^v \subseteq \mathcal{I}$ set of individuals who are eligible for category- v positions
 - $\mathcal{I}^o = \mathcal{I}$
 - $\mathcal{I}^c = \{i \in \mathcal{I} : \rho(i) = c\}$ for any $c \in \mathcal{R}$

Solution Concept: Choice Rule

- Given a category $\nu \in \mathcal{V}$, a **single-category choice rule** is a function $C^\nu : 2^{\mathcal{I}} \rightarrow 2^{\mathcal{I}^\nu}$ such that, for any $I \subseteq \mathcal{I}$,

$$C^\nu(I) \subseteq I \cap \mathcal{I}^\nu \quad \text{and} \quad |C^\nu(I)| \leq q^\nu.$$

- A **choice rule** is a function $C = (C^\nu)_{\nu \in \mathcal{V}} : 2^{\mathcal{I}} \rightarrow \prod_{\nu \in \mathcal{V}} 2^{\mathcal{I}^\nu}$ such that, for any $I \subseteq \mathcal{I}$,

- for any category $\nu \in \mathcal{V}$,

$$C^\nu(I) \subseteq I \cap \mathcal{I}^\nu \quad \text{and} \quad |C^\nu(I)| \leq q^\nu,$$

- for any two distinct categories $\nu, \nu' \in \mathcal{V}$,

$$C^\nu(I) \cap C^{\nu'}(I) = \emptyset.$$

- For any choice rule $C = (C^\nu)_{\nu \in \mathcal{V}}$, the resulting **aggregate choice rule** $\hat{C} : 2^{\mathcal{I}} \rightarrow 2^{\mathcal{I}}$ is given as

$$\hat{C}(I) = \bigcup_{\nu \in \mathcal{V}} C^\nu(I) \quad \text{for any } I \subseteq \mathcal{I}.$$

Horizontal Reservations

- HR policy is managed through a system of trait ownership.
- \mathcal{T} Set of **traits** associated with HR protections
 - Each trait represents a societal disadvantage
- $\tau : \mathcal{I} \rightarrow 2^{\mathcal{T}}$ **Trait function** that identifies each individual's traits
- q_t^v Given $v \in \mathcal{V}$ and $t \in \mathcal{T}$, **minimum** # of category- v positions that must be **guaranteed** to eligible individuals with trait t
 - Called **category- v HR-protected positions for trait t** .

Horizontal Reservations

- While each individual is a member of a single category in $\mathcal{R} \cup \{g\}$ in India, she may have multiple traits.
- We refer to HR policies where an individual can have at most one trait as **non-overlapping HR protections**, and HR policies where an individual can have multiple traits as **overlapping HR protections**.
- We start our analysis with the more basic case of non-overlapping HR protections.
 - It is (considerably) simpler
 - Court rulings are presented for this case
 - The SCI-AKG choice rule is not well-defined for the more general case
 - The failure is already prominent in this case
 - Policy implications of our findings are sharper in this case

Horizontal Reservations

- HR protections are provided within each vertical category on a **minimum guarantee** basis.
 - This means that positions obtained without invoking any HR protection still accommodate the HR protections.
- Given any category $v \in \mathcal{V}$, category- v HR protections can be implemented with the following choice rule:

Minimum Guarantee Choice Rule C_{mg}^v (Echenique & Yenmez 2015)

Given a set of individuals $I \subseteq \mathcal{I}^v$,

Step 1. for each trait $t \in \mathcal{T}$, assign HR-protected positions to highest merit-score individuals in I who have trait t .

Step 2. For positions unfilled in Step 1 (open or HR-protected), choose the highest merit-score individuals in I who are still unassigned.

Concurrent Implementation of VR and HR Protections

- Since
 - VR Protections are implemented on an over-and-above basis, and
 - HR Protections are implemented within each vertical category on a minimum guarantee basis,

in Sönmez & Yenmez (2022) we propose the following two step implementation of the minimum guarantee choice rule as a natural procedure for the concurrent implementation of the two policies:

2-Step Minimum Guarantee Choice Rule (2SMG) $C_{mg}^{2s} = (C_{mg}^{2s,\nu})_{\nu \in \mathcal{V}}$

Given a set of individuals $I \subseteq \mathcal{I}$,

$$\text{Step 1.} \quad C_{mg}^{2s,o}(I) = C_{mg}^o(I)$$

$$\text{Step 2.} \quad C_{mg}^{2s,c}(I) = C_{mg}^c\left(\left(I \setminus C_{mg}^o(I)\right) \cap \mathcal{I}^c\right) \quad \text{for any } c \in \mathcal{R}$$

End of an Era with Saurav Yadav (2020)

- *Saurav Yadav (2020)* marks the end of an era where a three-judge bench of the Supreme Court brought an end to the 25 years tenure of the AKG-SCI choice rule and endorsed the 2SMG choice rule.
 - The 2SMG choice rule first appeared in Indian court rulings with the August 2020 High Court of Gujarat judgment *Tamannaben Ashokbhai Desai (2020)* where it became **mandated for the State of Gujarat**.
- Another key mandate in *Saurav Yadav (2020)* is the **enforcement** of the axiom of **no justified envy**, in case a choice rule that differs from 2SMG is adopted by a public institution.
- Perhaps due to the aftermath of the enforcement of the AKG-SCI choice rule, the justices of the Supreme Court have **merely endorsed** the 2SMG choice rule and they refrained from enforcing it.

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- Perhaps due to the aftermath of the enforcement of the AKG-SCI choice rule, the justices of the Supreme Court have **merely endorsed** the 2SMG choice rule and they refrained from enforcing it.
- **However, there is one misleading aspect of this “seemingly” more flexible guidance on the selection of an allocation mechanism!**

Desiderata Mandated under Saurav Yadav (2020)

- Accurately identifying the root cause of the crisis as the failure of *no justified envy* under the rescinded SCI-AMG choice rule, the justices have mandated this important axiom under *Saurav Yadav (2020)*.
- On top of this axiom, three additional desiderata are also mandated with this landmark judgment.

Desiderata Mandated under Saurav Yadav (2020)

- Accurately identifying the root cause of the crisis as the failure of *no justified envy* under the rescinded SCI-AKG choice rule, the justices have mandated this important axiom under *Saurav Yadav (2020)*.
- On top of this axiom, three additional desiderata are also mandated with this landmark judgment.

We next formulate all four mandates as rigorous axioms.

Desiderata Mandated under Saurav Yadav (2020)

- A choice rule $C = (C^v)_{v \in \mathcal{V}}$ is **non-wasteful** if, for every $I \subseteq \mathcal{I}$, $v \in \mathcal{V}$, and $j \in I$,

$$j \notin \widehat{C}(I) \text{ and } |C^v(I)| < q^v \implies j \notin \mathcal{I}^v.$$

- A position can remain idle at any category $v \in \mathcal{V}$ **only if** none of the individuals who remain unassigned is eligible for a category- v position.
- This mild efficiency axiom has been mandated in India since *Indra Sawhney (1992)*.

Desiderata Mandated under Saurav Yadav (2020)

- The following auxiliary concept simplifies the formulation of our next three axioms.
- Given a vertical category $v \in \mathcal{V}$, the (category- v) **HR-maximality function** $n^v : 2^{\mathcal{I}^v} \rightarrow \mathbb{N}$ is defined as follows:

For any $I \subseteq \mathcal{I}^v$,

$$n^v(I) = \sum_{t \in \mathcal{T}} \min \left\{ |\{i \in I : t \in \tau(i)\}|, q_t^v \right\}.$$

- For any category v and set of individuals I who are eligible for category- v positions, this function gives the maximum number of HR-protected positions that can be **honored** (i.e. awarded to their intended beneficiaries).

Desiderata Mandated under Saurav Yadav (2020)

- A choice rule $C = (C^v)_{v \in \mathcal{V}}$ **maximally accommodates HR protections** if, for every $I \subseteq \mathcal{I}$, $v \in \mathcal{V}$, and $j \in (I \cap \mathcal{I}^v) \setminus \widehat{C}(I)$,

$$n^v(C^v(I) \cup \{j\}) \not\leq n^v(C^v(I)).$$

- An individual cannot remain unassigned if she can increase the number of HR-protected positions that are honored at some category for which she has eligibility.
- Became mandated in India with *Saurav Yadav (2020)* in this form.
- Fails under the rescinded SCI-AMG choice rule, because VR-protected individuals had been deemed ineligible for HR protections within open positions under this rule.

Desiderata Mandated under Saurav Yadav (2020)

- A choice rule $C = (C^v)_{v \in \mathcal{V}}$ satisfies **no justified envy** if, for every $I \subseteq \mathcal{I}$, $v \in \mathcal{V}$, $i \in C^v(I)$, and $j \in (I \cap \mathcal{I}^v) \setminus \widehat{C}(I)$,

either $\sigma(i) > \sigma(j)$ or $n^v(C^v(I)) > n^v((C^v(I) \setminus \{i\}) \cup \{j\})$.

- At any category $v \in \mathcal{V}$, a lower merit-ranking individual $i \in \mathcal{I}^v$ can receive a position at the expense of a higher merit-ranking individual $j \in \mathcal{I}^v$ who remains unassigned **only if** replacing i with j decreases the number of HR-protected positions that are honored at category v .
- Mandate of this axiom is the **main message** of *Saurav Yadav (2020)*.
- In India, widely referred to as the **principle of merit** for $v = o$, and as the **principle of inter se merit** for $v \in \mathcal{R}$.

Desiderata Mandated under Saurav Yadav (2020)

- A choice rule $C = (C^\nu)_{\nu \in \mathcal{V}}$ **complies with VR protections** if, for each set of individuals $I \subseteq \mathcal{I}$ and reserve-eligible category $c \in \mathcal{R}$, whenever $i \in C^c(I)$ (and hence $i \notin C^o(I)$) the following three conditions hold:
 - $|C^o(I)| = q^o$,
 - for every $j \in C^o(I)$,

either $\sigma(j) > \sigma(i)$ or $n^o(C^o(I)) > n^o((C^o(I) \setminus \{j\}) \cup \{i\})$, and
 - $n^o(C^o(I) \cup \{i\}) \not\geq n^o(C^o(I))$.
- Here the first two conditions formulate the idea of a vertical reservation à la Indra Sawhney (1992).
- The third condition is a **new mandate** in *Saurav Yadav (2020)*, and it additionally requires that a member of a reserve-eligible category who can increase the number of HR-protected positions that are honored at open category shall not be instead awarded a VR-protected position.

Significance of the Last Axiom

- Apart from enforcing the axiom of *no justified envy* and rescinding the SCI-AKG choice rule, *Saurav Yadav (2020)* also brings a much needed clarity to a subtle aspect of implementation of VR protections in the presence of HR protections.
- When the concept of vertical reservations was introduced in *Indra Sawhney (1992)*, its defining characteristics was described as follows:

"It may well happen that some members belonging to, say Scheduled Castes get selected in the open competition field on the basis of their own merit; they will not be counted against the quota reserved for Scheduled Castes; they will be treated as open competition candidates."

Significance of the Last Axiom

- However, no judgment of the Supreme Court prior to *Saurav Yadav (2020)* explicitly formulated what it means to **get selected in the open competition on the basis of merit** when there are also HR protections.
- To a large extent, much of the disarray in relation to concurrent implementation of VR and HR policies boils down to this ambiguity.
 - An key (but underutilized) role for a market designer is bringing formalism to analytical concepts developed by layman or experts in on-technical fields.
- This vagueness is now removed under *Saurav Yadav (2020)*, where an individual who gets selected in the open competition on the basis of merit is legally defined as one who deserves an open category position on the basis of merit **with or without invoking the HR protections**.

A Hidden Implication of Saurav Yadav (2020)

- Collectively, the mandates in *Saurav Yadav (2020)* have a very sharp policy implication.

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Theorem (Sönmez & Yenmez, 2022)

Suppose each individual has at most one trait. A choice rule

1. *is non-wasteful,*
2. *maximally accommodates HR protections,*
3. *satisfies no justified envy, and*
4. *complies with VR protections*

if, and only if, it is the 2SMG choice rule C_{mg}^{2s} .

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- Therefore, while *Saurav Yadav (2020)* has not explicitly enforced and merely endorsed the 2SMG choice rule, it has indirectly enforced this choice rule through its other mandates!

Convention Selection for Overlapping HR Protections

- We next extend our analysis to the general version of the problem with overlapping HR protections.
- In India VR-protected groups do not overlap with each other, although they overlap with HR-protected groups.
- So far we have assumed that HR-protected groups do not overlap with each other either (i.e. individuals have at most one trait).
 - Court cases seem to abstract away from any complications due to overlapping HR-protected groups.
- However in many field applications, HR-protected groups overlap.
 - Eg: HR protections for Women and Persons with Disabilities
- **Key Question:** Does a member of multiple HR-protected groups count towards minimum guarantees for all these groups or only one of them upon admission?
 - Unlegislated and left at the discretion of central planner

Implementation of Overlapping HR Protections

- We adopt the latter **one-to-one HR matching** convention.
 - Clean solution
 - More widespread in the field
 - Position numbers are typically announced for category-trait pairs, which automatically embeds this convention into the solution

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For example, the following Table is from *Saurav Yadav (2020)*:

B. Horizontal reservation position is as follows-

Table-2

Vertical Reservation	Total Vacancies	Horizontal Reservation Vacancies			
		Ex-Serviceman 05%	DFP 02%	Home-Guard (only for civil police & PAC 05%)	Female (only for civil police) 20%
Open	20804	1040	416	988	3550
OBC	11235	562	225	534	1917
SC	8738	437	175	415	1491
ST	833	42	17	40	142
Total	41610	2081	833	1977	7100

Implementation of Overlapping HR Protections

- **Question:** Why not simply using a two-step implementation of the minimum guarantee choice rule for this case as well?

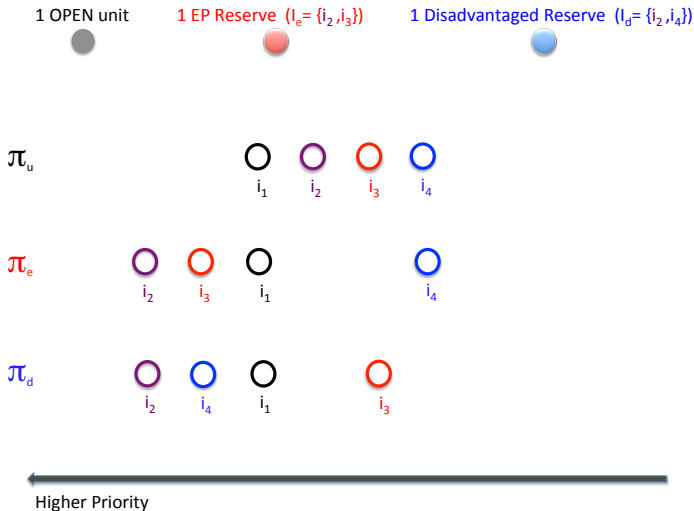
Minimum Guarantee Choice Rule C_{mg}^v

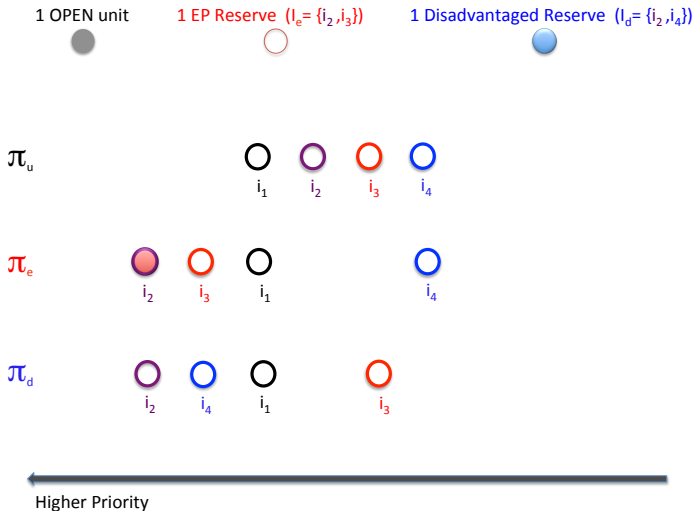
Given a set of individuals $I \subseteq \mathcal{I}^v$,

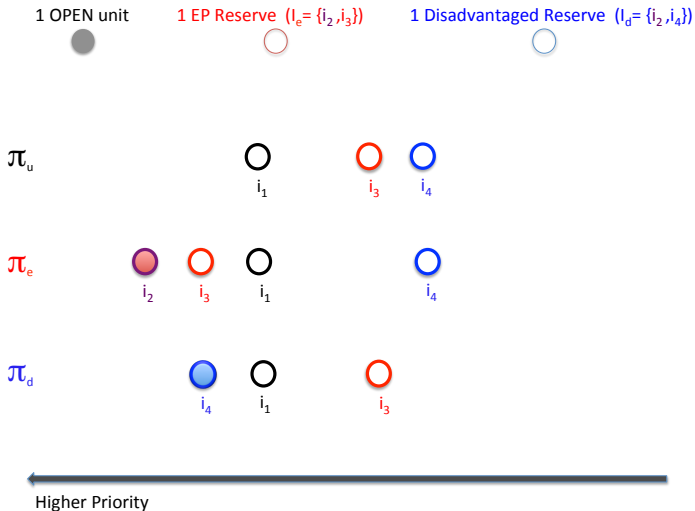
Step 1. for each trait $t \in \mathcal{T}$, choose all individuals in I with trait t if their number is less than or equal to q_t^v , and q_t^v highest merit-score individuals in I with trait t otherwise.

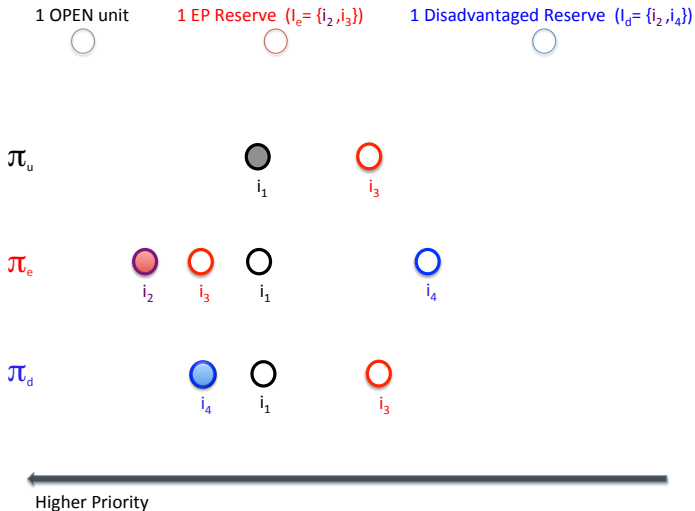
Step 2. For positions unfilled in Step 1, choose the highest merit score individuals in I who are still unassigned.

Example: Needless Rejection of High-Merit Individuals



Processing Sequence: $E \triangleright D \triangleright O$ 

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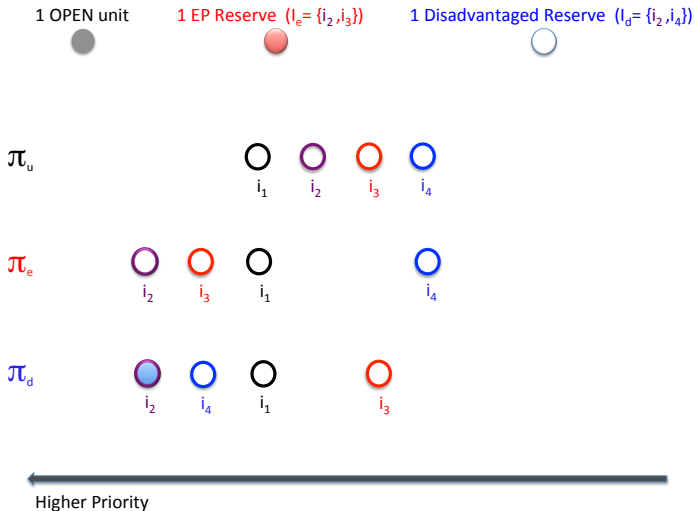
E ▷ D ▷ O:

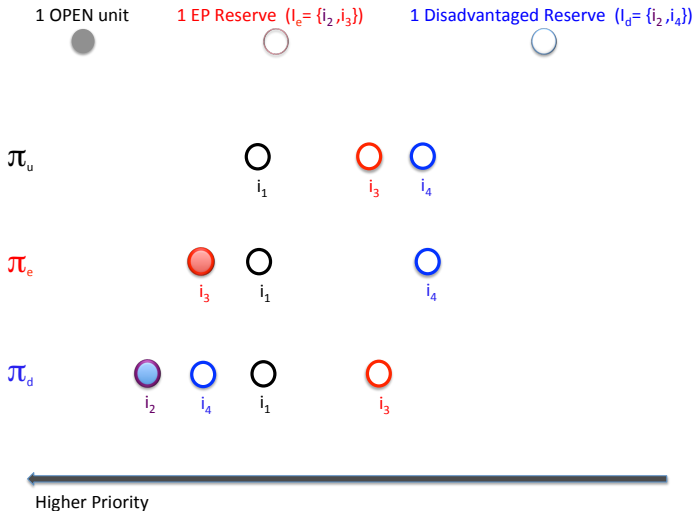
 i_4 Receives a Unit at the Expense of i_3

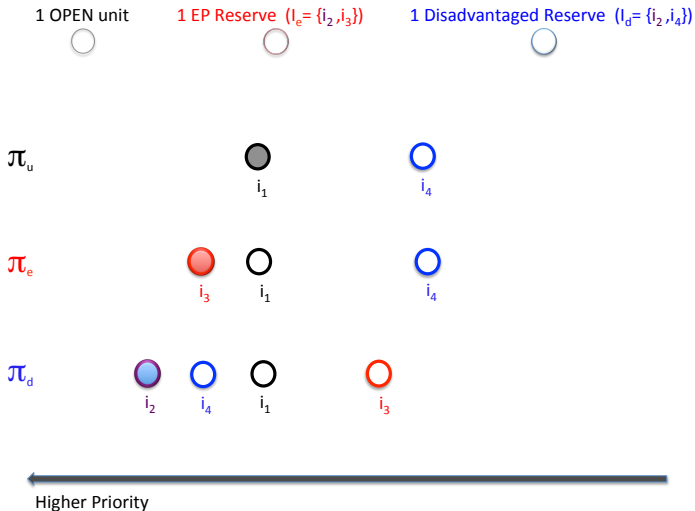
1 OPEN unit

1 EP Reserve ($l_e = \{i_2, i_3\}$)1 Disadvantaged Reserve ($l_d = \{i_2, i_4\}$) π_u  i_1  i_2  i_3  i_4 

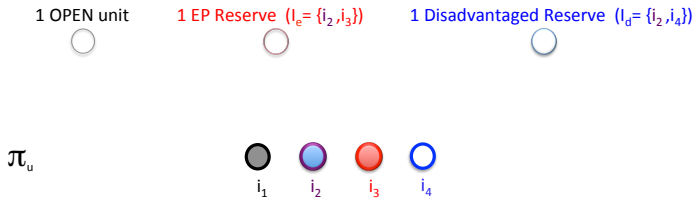
Higher Priority

Processing Sequence: $D \triangleright' E \triangleright' O$ 

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Processing Sequence: $D \triangleright' E \triangleright' O$ 

D \triangleright' E \triangleright' O: A More Meritorious Allocation of Positions



← Higher Priority

Implementation of Overlapping HR Protections

- **Bottomline:** Processing HR protections in a “mechanical” way with a fixed sequence of traits may lead to implausible outcomes.
 - The outcome may depend on the processing sequence of HR-protected groups.
 - Higher merit-score individuals can be rejected at the expense of lower merit-score individuals without increasing the overall representation of HR-protected groups.
 - HR-protected groups may be needlessly underrepresented.
- Admission of an individual with multiple traits presents a “flexibility” in accommodating HR protections; one that is lost under the minimum guarantee choice rule.

Implementation of Overlapping HR Protections

- This flexibility can be utilized to obtain a more meritorious outcome.
- To formulate a choice rule that achieves this objective, we first need to generalize the HR-maximality function for each category $v \in \mathcal{V}$.
- When HR-protected groups do not overlap, this function is simply given as:

For any $I \subseteq \mathcal{I}^v$,

$$n^v(I) = \sum_{t \in \mathcal{T}} \min \left\{ |\{i \in I : t \in \tau(i)\}|, q_t^v \right\}.$$

- It is trivial for the case of non-overlapping HR protections, because, processing of HR protections for different groups do not interfere with each other in this simpler environment.

Generalized HR-Maximality Function

- In contrast, the maximum number of HR-protected positions that can be honored depends on who accounts for which minimum guarantee constraint when HR protections overlap.
- Given a category $v \in \mathcal{V}$ and set of individuals $I \in \mathcal{I}^v$, let $n^v(I)$ be the maximum number of HR-protected positions that can be awarded.
 - This number can be found through several polynomial time algorithms such as **Edmonds' Blossom Algorithm** (Edmonds, 1965).
 - Requires **maximal matching** of individuals to traits.
- Given a category $v \in \mathcal{V}$ and a set of individuals $I \subseteq \mathcal{I}^v$, an individual $i \in \mathcal{I}^v \setminus I$ **increases HR utilization of I** if

$$n^v(I \cup \{i\}) = n^v(I) + 1.$$

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$$n^v(I \cup \{i\}) = n^v(I) + 1.$$

- We are ready to formulate a choice rule that utilizes the flexibility in accommodating the HR protections under the one-to-one HR matching convention.

Meritorious Horizontal Choice Rule

Meritorious Horizontal Choice Rule C_{M}^{V}

Step 1.1 Choose the highest merit-score individual in I with an HR-protected trait. Denote this individual by i_1 and let $I_1 = \{i_1\}$. If no such individual exists, proceed to Step 2.

Step 1.k ($k > 1$) Assuming such an individual exists, choose the highest merit-score individual in $I \setminus I_{k-1}$ who increases the HR utilization of I_{k-1} . Denote this individual by i_k and let $I_k = I_{k-1} \cup \{i_k\}$. If no such individual exists, proceed to Step 2.

Step 2 For unfilled positions, choose unassigned individuals with highest merit scores until either all positions are filled or all individuals are selected.

Single-Category Results

- The following result justifies the naming of the meritorious horizontal choice rule $C_{\text{M}}^{\mathcal{V}}$.

Proposition (Sönmez & Yenmez, 2022)

Given a category $\mathcal{v} \in \mathcal{V}$, let $C^{\mathcal{V}}$ be any single-category choice rule that maximally accommodates HR protections. Then, for every set of individuals $I \subseteq \mathcal{I}^{\mathcal{V}}$,

- $|C^{\mathcal{V}}(I)| \leq |C_{\text{M}}^{\mathcal{V}}(I)|$, and*
- for every $k \leq |C^{\mathcal{V}}(I)|$, if i is the k -th highest merit-score individual in $C_{\text{M}}^{\mathcal{V}}(I)$ and j is the k -th highest merit-score individual in $C^{\mathcal{V}}(I)$, then*

$$i = j \quad \text{or} \quad \sigma(i) > \sigma(j).$$

Single-Category Results

- The next result shows that the meritorious horizontal choice rule $C_{\mathbb{M}}^{\mathcal{V}}$ is the only plausible procedure to accommodate the HR protections under the one-to-one HR matching convention.

Theorem (Sönmez & Yenmez, 2022)

Given a category $v \in \mathcal{V}$, a single-category choice rule

- 1. is non-wasteful*
- 2. maximally accommodates HR protections, and*
- 3. satisfies no justified envy,*

if, and only if, it is the meritorious horizontal choice rule $C_{\mathbb{M}}^{\mathcal{V}}$.

2-Step Meritorious Horizontal Choice Rule

- We are ready to formulate and propose a choice rule for our model in its full generality.

2-Step Meritorious Horizontal Choice Rule (2SMH) $C_{\textcircled{M}}^{2s} = (C_{\textcircled{M}}^{2s,\nu})_{\nu \in \mathcal{V}}$

Given a set of individuals $I \subseteq \mathcal{I}$,

Step 1. $C_{\textcircled{M}}^{2s,o}(I) = C_{\textcircled{M}}^o(I)$

Step 2. $C_{\textcircled{M}}^{2s,c}(I) = C_{\textcircled{M}}^c\left(\left(I \setminus C_{\textcircled{M}}^o(I)\right) \cap \mathcal{I}^c\right)$ for any $c \in \mathcal{R}$

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- Simplifies to the 2SMG choice rule when HR protected groups do not overlap.

Uniqueness of the 2SMH Choice Rule

- Our next result establishes that the 2SMH choice rule is the only plausible allocation mechanism for the general case of the problem with overlapping HR protections.

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if, and only if, it is the 2SMH choice rule $C_{\mathbb{M}}^{2s}$.

Increased-Scope for Experts in Market Design

- Over the years Indian judges have done a fantastic job of formulating various desiderata for reservation policies, but designing mechanisms to implement these desiderata often requires additional expertise.
 - This is where collaboration with market designers can provide very concrete benefits to the society.
- The failure of the AKG-SCI choice rule is only the tip of the iceberg. For example, the problem has a more complex version in India where positions are heterogenous across multiple institutions.
 - Supreme Court judgments for this version of the problem not only have similar failures, but in addition they are also inconsistent with each other (Sönmez & Yenmez 2022b).

Policy Advice for Allocation of Heterogenous Positions

- Based on the following two results, the prescription of minimalist market design for this more elaborate version of the problem is **2SMH+DA**, a joint implementation of the 2SMH choice rule with the deferred acceptance algorithm.

Theorem (Sönmez & Yenmez, 2022b)

Of all mechanisms that satisfy

1. *individual rationality,*
2. *non-wastefulness,*
3. *maximal accommodation of HR protections,*
4. *no justified envy, and*
5. *compliance with VR protections*

the mechanism 2SMH+DA Pareto dominates any other.

Policy Advice for Allocation of Heterogenous Positions

Theorem (Sönmez & Yenmez, 2022b)

A mechanism satisfies

1. *individual rationality,*
2. *non-wastefulness,*
3. *maximal accommodation of HR protections,*
4. *no justified envy,*
5. *compliance with VR protections, and*
6. *strategy-proofness*

if and only if it is the mechanism 2SMH+DA.